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CELESTRON®

MAKSUTOV-CASSEGRAIN **TELESCOPES** C90 SERIES INSTRUCTIONS

93988

CELESTRON®

MAKSUTOV-CASSEGRAIN
TELESCOPES
C90 SERIES
INSTRUCTIONS

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2835 Columbia Street
Torrance, CA 90503
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Written by Timothy Cann. Edited by Rebecca Kalis.
Illustrations by Pamela Crews and Taylor-Made Graphics.
Some photographs by Dingeman Kalis.

CAUTION! PLEASE READ

NEVER ATTEMPT TO VIEW THE SUN THROUGH ANY TELESCOPE WITHOUT A PROPER FILTER.

VIEWING THE SUN WITHOUT A PROPER FILTER MAY RESULT IN PERMANENT BLINDNESS, AS WELL AS DAMAGE TO THE TELESCOPE. NEVER ALLOW CHILDREN TO USE THE TELESCOPE DURING DAYLIGHT HOURS UNLESS THEY ARE SUPERVISED BY AN ADULT WHO IS FAMILIAR WITH THESE INSTRUCTIONS.

POINTERS WHEN USING YOUR TELESCOPE TO OBSERVE THE SUN

1. NEVER look at the sun without a solar filter. Solar observing by children should always be conducted under adult supervision.
2. NEVER observe the sun through your telescope without having equipped it with the properly manufactured lens filtering device to optically reduce light energy. Observing without a filter will result in instant, permanent damage to your eye (blindness), even during a solar eclipse.
3. The smallest finderscopes collect sufficient light to cause eye damage. Keep the lens cover(s) on finderscopes.
4. Pointing a non-filtered telescope at the sun can result in serious damage to the instrument. Optical coatings can be ruined, and optical glass components may shatter.
5. Celestron offers safe, precision solar filters. The only safe solar filters fit completely over the front of the telescope and provide full diameter coverage of the lens to reduce the sun's intensity.
6. Celestron does not recommend eyepiece solar filters or Herschel Wedge (prism) solar filters.

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SPECIAL NOTES

Your Celestron C90 Series instruction book is designed to be inserted into Chapter 5 of the Celestron Product Guide and Reference Manual available through your Celestron dealer.

For Southern Hemisphere Users of the C90 Astro:

This edition has been prepared for Northern Hemisphere users. If you live in the Southern Hemisphere and purchased a Celestron C90 Astro specially manufactured for use in that part of the world, some of the electrical specifications and references to guide marks in this manual will be different. You will also note that some references to adjustments to compensate for the movement of the Earth will need to be reversed. Special instructions and hints for Southern Hemisphere users of Celestron equipment are included in the Celestron Product Guide and Reference Manual. Please ask your local dealer or write directly to Celestron if you would like to obtain this manual.

CELESTRON C90 SERIES

C90 Astro

The Celestron C90 Series consists of a series of compact, light weight, and easy to use telescopes and spotting scopes for astronomers and naturalists who want maximum portability. The series includes the C90 Astro telescope, the C90 Spotting Scope, the C90 Big Eye Spotting Scope, and the C90 Telephoto lens.

The C90's Maksutov-Cassegrain optical system is catadioptric, that is, a combination of lenses and mirrors forms the image. As a result, it is exceptionally compact. The tube is only eight inches long. The C90's focal length is 1000mm with an aperture size of 90mm. Images are

extremely crisp. Depending on which version and which accessories you choose, the C90 can be used as an astronomical telescope, as a spotting scope, or as a telephoto lens attached to a camera. Each model in the series is affordable, durable, and meets Celestron's high quality standards.

This manual is intended to get you started using and enjoying your C90 Series instrument. In it you will find instructions on how to set up and use the system for terrestrial and astronomical observing as well as how to use the system to take photographs of things on earth and in the skies. If you are just starting this informative and enjoyable hobby, you will find information and advice on getting going. If you are more advanced, you will discover the detailed information that you will need to get the most out of the system.

Before doing anything else, we suggest you first review the features of the C90 Series described below. Then, read through completely the instructions on how to unpack and assemble your instrument. After you have the system assembled, the "Getting Started" section, which includes general information on astronomy as well as telescope use, will put you on the right track to hours and years of enjoyment. If you are already familiar with telescopes, you will probably be able to skim over the basics and quickly get to "How To Use the C90." In this part of the manual, you will find detailed instructions on advanced telescope alignment, how to locate astronomical objects, and how to use the system for photography.

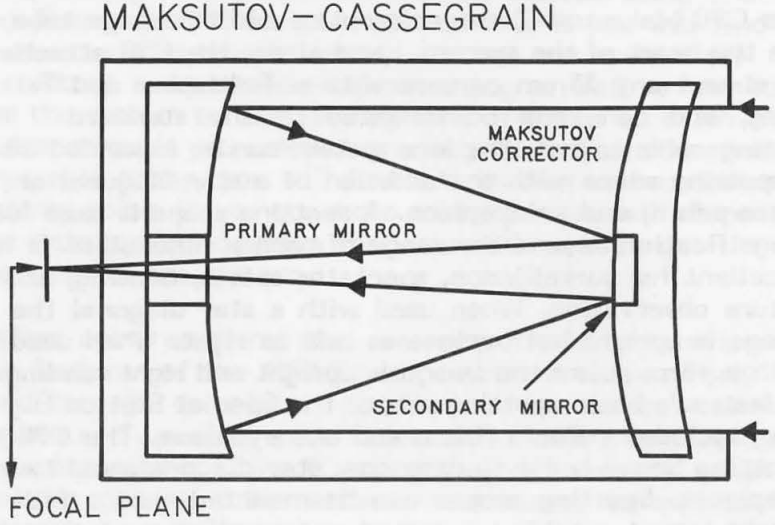
All users of the C90 Series will want to review the final two sections: "How to Expand Your System," which describes a large number of useful Celestron accessories, and "Care and Maintenance," which will help you take care of your new fine instrument.

C90 SERIES FEATURES

All models in the C90 Series share certain common features and accessories. And, in all cases, the optics are identical. Depending on your needs, you can purchase any one of the C90 Series and later add additional accessories to extend its capabilities and increase your enjoyment. The C90 Maksutov-Cassegrain optics and telescope tube are the heart of the system. Used alone, the C90 attaches to almost any 35mm camera with a T-Adapter and T-Ring, and can then be mounted to any standard photographic tripod. The lens system can be expanded into a spotting scope with the addition of a star diagonal or porro prism, and an eyepiece. A spotting scope is used for magnification beyond the range of normal binoculars. It is excellent for surveillance, spectator sports, hunting, and nature observation. When used with a star diagonal the image is upright but backwards left to right. When used with a porro prism the image is upright and right reading. Celestron's basic spotting scope, the Special Edition Big Eye, includes a Porro Prism and one eyepiece. The C90 Spotting Scope has a finderscope, star diagonal, and two eyepieces. Spotting scopes can be mounted onto a full-height tripod, a table top tripod or to a number of clamps that attach to the car widow or doors. Both spotting scopes can also be used as a telephoto lens with the addition of a T-Adapter for your camera.

A Celestron Spotting Scope can also be used as a celestial telescope to look at the moon or other large astronomical objects. The C90 Spotting Scopes do not include an equatorial mount or clock drive, so tracking objects in the sky is sometimes difficult. However, the C90 Astro model combines the features of the C90 Spotting Scope with a heavy duty Swing Through Equatorial Fork Mount and clock drive. As a result, the C90 Astro is an excellent compact telescope for the serious beginner and a fine second telescope for the serious astronomer who wants a portable telescope, or a guidescope. For additional use as a powerful telephoto lens a T-Adapter and T-Ring for

your camera are the only required accessories. These same two accessories make the C90 an excellent instrument for lunar and planetary photography.



OPTICS

The C90 Series uses the Maksutov-Cassegrain catadioptric optical system to obtain bright images and, for a compact portable instrument, a long focal length. The system has three elements: the Maksutov corrector; a concave primary mirror; and an aluminized spot on the corrector. The corrector lens can be seen at the front of the telescope. On its inside surface is the aluminized spot. The curved concave primary mirror is at the back. Light enters the telescope and is bent slightly (corrected) by the corrector plate. It is then reflected by the primary

mirror to the aluminized spot and, finally, passes through the hole in the center of the primary mirror to the eyepiece. A large dust cap protects the mirrors and lens when the instrument is not in use.

The C90 Series has an 90mm (3.55") diameter objective which gathers sufficient light to see 14th magnitude objects on nights of good seeing. With a focal length of 1000mm and an 18mm Kellner eyepiece, objects are magnified 55 times. The C90's f/11 focal ratio gives you bright images with ample magnification for superb views of the moon, planets or objects on earth.

EYEPIECES

All instruments in the C90 Series (except the Special Edition Big Eye) include two 0.96 inch eyepieces - - the 18mm and 30mm Kellner which magnify objects 55 times and 33 times respectively. The Kellner eyepiece, designed for general purpose, all around use, is best for lunar and planetary viewing. It has a moderate apparent field of view: approximately 40 degrees. The Kellner eyepiece has fairly good eye relief, that is, the eye does not have to be as close to the eyepiece as with other designs. The C90 Special Edition Big Eye includes only the 30mm Kellner eyepiece. Other types of eyepieces are available for the C90 in focal lengths from 4mm (250x) to 45mm (22x).

FINDERSCOPE

The C90 Spotting Scope and C90 Astro include a 5x24 wide angle refractor finderscope for locating objects. With its wide field of view, you can easily locate objects before viewing them in the main telescope. If you are familiar with the constellations, the finder may be all you need to locate many objects in the sky.

STAR DIAGONAL

The C90 Astro telescope and C90 Spotting Scope include a prism star diagonal to make your viewing angle more comfortable. The unit joins two tubes at right angles. A high quality prism bends light coming into one of the tubes so it exits at a right angle through the other tube. The silver end of the star diagonal fits into the visual back. The 0.96 inch eyepiece is then placed into the black tube of the star diagonal. Both are locked in place by tightening the thumb screws.

PORRO PRISM

When you look through the eyepiece on any uncorrected telescope, the image is upside down and backwards. The Porro Prism included with the Big Eye corrects this through the use of a set of high quality, right angle prisms set at 90 degrees to each other. The Porro Prism makes bird watching or general terrestrial viewing easier and more enjoyable.

VISUAL BACK

The visual back built into the C90 Series telescopes holds 0.96 inch eyepieces or other visual accessories. The silver thumb screw is used to secure an eyepiece in the visual back. A plastic cap covers the open hole in the visual back when you are not using it to protect the telescope from contaminants and other hazards.

MOUNT

The heavy duty Swing-Through Equatorial half-fork mount of the C90 Astro telescope provides a superb mounting system for you to use while looking at astronomical as well as terrestrial objects. This system of mechanical and electrical components provides mounting features and functions necessary for you to find, observe, track, and

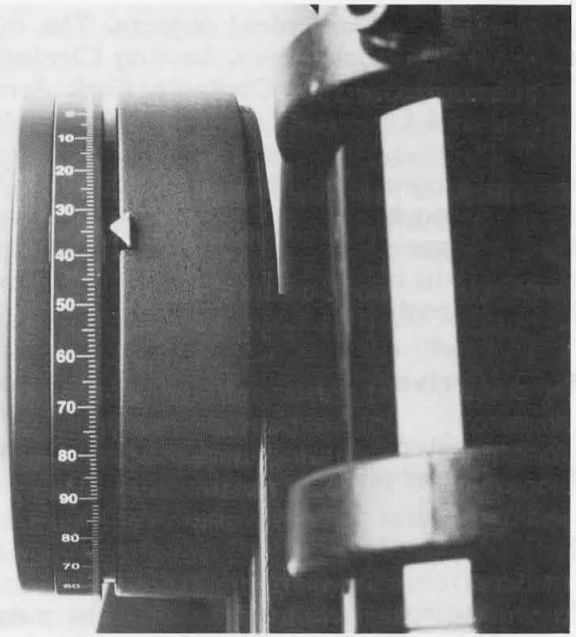
photograph astronomical objects. The mount consists of an Electric Clock Drive, Setting Circles, Motion Locks, Manual Slow Motion Controls, Fork Arm, and optional Tripod and Equatorial Wedge. This special drive system's unique features are most noticeable during long exposure astrophotography. With it, no guiding is normally required during piggyback photography. Once the telescope has been properly aligned with the celestial pole, little guiding will be necessary even during long exposure prime focus astrophotography.

Clock Drive

The Celestron spur gear clock drive insures smooth visual tracking and photographic guiding.

Setting Circles

Setting circles are precision angle measuring devices mounted to the two axes of the C90 Astro's equatorial mount. Used to locate objects in the nighttime sky, setting circles work like the latitude and longitude measurements on the earth's surface. Star charts and other astronomical publications specify the location of objects using the standard locator coordinates called Right Ascension (East - West) and Declination (North - South).



Declination Setting Circle

Motion Locks

The C90 Astro telescope is moved from object to object by hand. To secure the position of the telescope on a specific object, a lock is provided for each axis.

Manual Slow Motion Controls

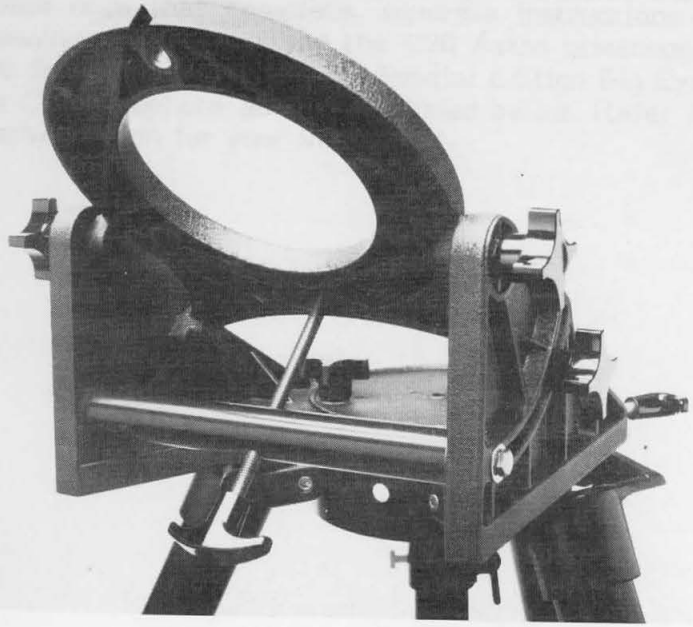
Hand operated slow motion controls are on the Right Ascension and Declination Axes. These controls are used to make small adjustments after the motion locks have been tightened.

Fork Arm

The Celestron fork arm is made of precision die cast aluminum. The arm is designed for maximum rigidity with a minimum of weight. The half-fork design equatorial mount is compact and light in weight (no counterweights needed) and can be used to observe any part of the sky.

EQUATORIAL WEDGE (Optional)

The optional Equatorial Wedge, which is equipped a Bubble Level and Latitude Scale, assists you in aligning the C90 Astro telescope with the Celestial Pole.



Equatorial Wedge

ADJUSTABLE TRIPOD (Optional)

The optional Celestron Adjustable Tripod is a sturdy, three point portable mounting base for use in almost any terrain. The extendable legs have a unique cam action and thumb screw locking system to make it possible to set up your telescope, level it, and use it with safety and stability.

PHOTOGRAPHIC TRIPOD (Optional)

The optional Photographic Tripod provides a stable support for the C90 Spotting Scopes. The tripod has an extendable central column, adjustable legs and locks to secure the camera or spotting scope.

UNPACKING & ASSEMBLING THE C90 SERIES

Please read the following instructions before unpacking your C90. Then take a minute to organize the boxes and the area in which you will set it up.

The Celestron C90 Series instruments are each packed in a foam padded carrying case inside a cardboard box. After removing the pieces, discard the box. C90 eyepieces and the star diagonal will be found in a smaller foam padded box which can be stored in the carrying case to protect the visual components from dirt. Optional items and special accessories will be separately packed.

Please note that complete, separate instructions for unpacking and assembling the C90 Astro telescope, the C90 Spotting Scope, the C90 Special Edition Big Eye and the C90 Telephoto lens are included below. Refer to the proper section for your instrument.

SETTING UP THE C90 ASTRO

Step #1 Open The Boxes

The assembly instructions for the C90 Astro assume you have purchased the Adjustable Tripod and Wedge. Remove everything from the three boxes. You will find the following parts:

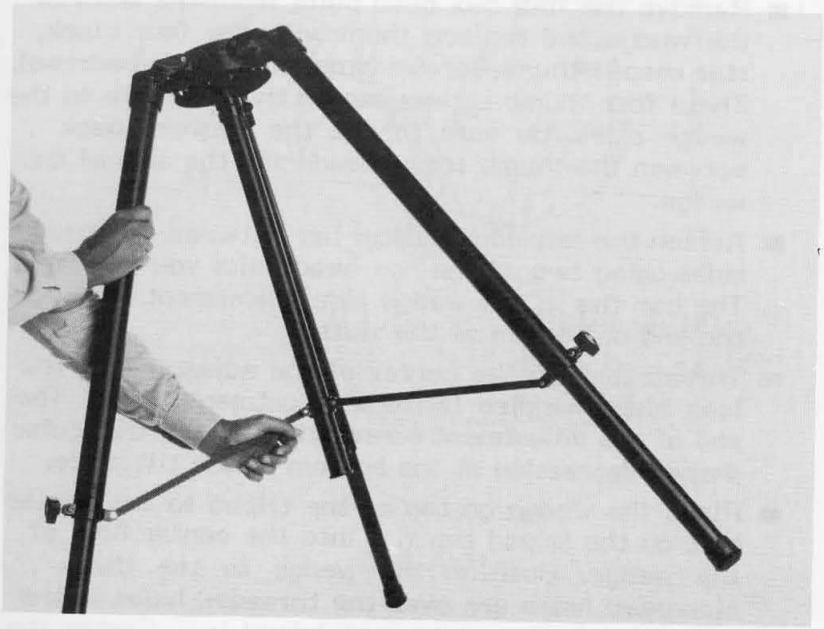
- Black C90 Astro Maksutov-Cassegrain Telescope
- 5 x 24 Finder
- Clock Drive
- Single arm fork Design Equatorial Mount with Declination and Right Ascension Locks and Manual Slow Motion Controls and Setting Circles
- Prism Star Diagonal
- 18mm Kellner Eyepiece
- 30mm Kellner Eyepiece
- Counterweights (2)
- Adjustable Tripod (Optional)
- Wedge (Optional)

If you did not purchase a tripod and wedge manufactured by Celestron, skip Steps #2 and #3 and proceed to Step #4.

Step #2 Set Up The Tripod

- Examine the tripod. At the top of each leg between the brackets is a round pencil sized center tab. This center brace contacts the tripod top when the legs are spread apart. BE CAREFUL NOT TO GET YOUR FINGERS CAUGHT. In the center of the tripod top is a silver colored threaded post. This post connects to a tube that extends inside the leg brace center post and can be used as a camera mount. A locking thumb lever at the top of the center post keeps this

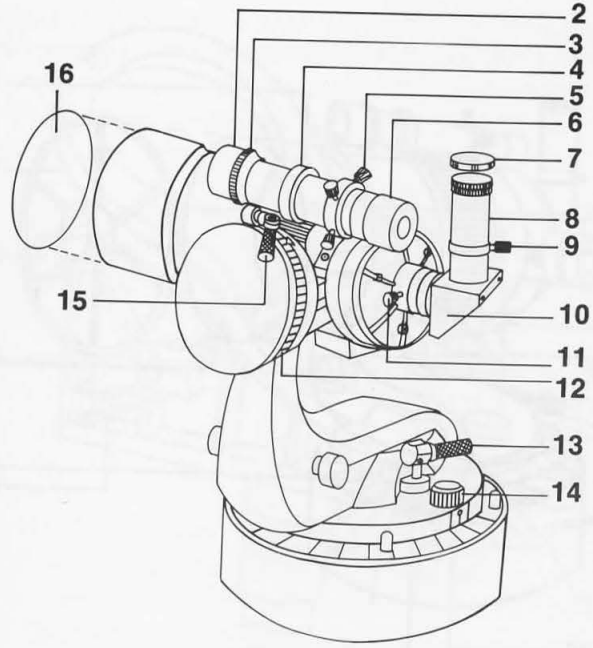
tube at the desired height or inside the leg brace center post. Make sure it is completely inside the leg brace center post when setting up the tripod.



Adjustable Tripod

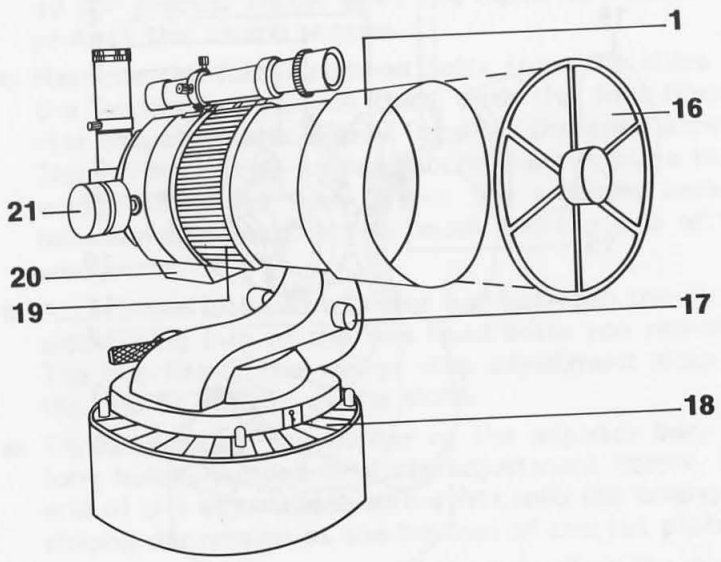
- Loosen the leg extension locking levers so they are at right angles to each leg. Extend each leg to a comfortable height and lock the leg extension thumb tab. If the tripod is to be used while standing, extend the legs until the tripod top is at waist height.
- Spread the tripod legs as far as possible. Make sure the triangular leg brace is pushed away from the tripod top.
- Locate the wedge. The bolts and washers will be used later.

- Locate the Deluxe Latitude Adjustor Kit. Separate all the pieces. Throw away the cardboard tubes that protect the thumb screws.
- Remove the four hex head bolts from the sides of the wedge and replace them with the four black, star shaped thumb screws (smaller threaded screws). These four thumb screws secure the tilt plate to the wedge sides. Be sure to put the washers back between the thumb screw heads and the side of the wedge.
- Attach the latitude adjustor bar between the wedge sides using two of the hex head bolts you removed. The bar fits in the wedge side adjustment slots at the end or bottom of the slots.
- Thread through the center of the adjustor bar, the long black handled latitude adjustment screw. The end of the adjustment screw fits into the triangular shaped depression at the bottom of the tilt plate.
- Place the wedge on top of the tripod so the center bolt on the tripod top fits into the center hole of the wedge. Position the wedge so the three elongated holes are over the threaded holes in the tripod top (adjacent to each tripod leg). Fasten the wedge to the tripod using the three black, round headed thumb screws (larger threaded screws).
- Thread the two black handled azimuth adjusting screws into the wedge where the wedge sides meet the circular wedge base. These screws contact two of the securing thumb screws. They are used to fine adjust the azimuth (East/West) position of the telescope. Never force these bolts. When adjusting the azimuth, always slightly loosen the three thumb screws that hold the wedge to the tripod to permit the adjustment. Then retighten.



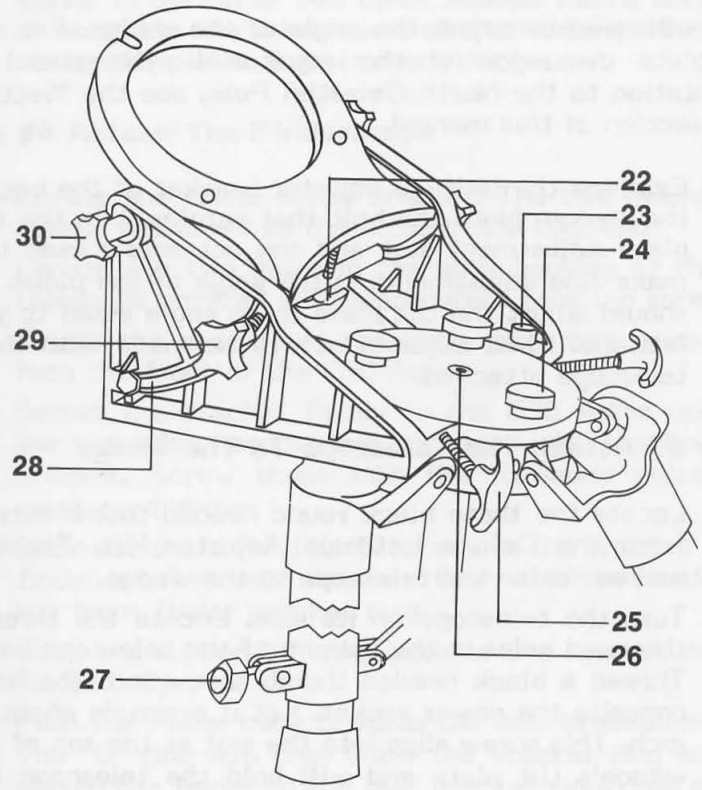
C90 Astro

1. Lens Shade
2. Finder Focus Ring
3. Finder Focus Lock Ring
4. Finder Bracket
5. Finder Alignment Thumb Screw (3)
6. Finder Eyepiece
7. Eyepiece Dust Cap
8. Eyepiece
9. Eyepiece Securing Thumb Screw
10. Star Diagonal
11. Visual Back Thumb Screw
12. Declination Setting Circle
13. Right Ascension Lock
14. Right Ascension Slow Motion
15. Declination Lock
16. Lens Cap



C90 Astro

1. Lens Shade
16. Lens Cap
17. Declination Slow Motion
18. Right Ascension Setting Circle
19. Telescope Focus Ring
20. Photo Tripod Mounting Pad
21. Counterweight



C90 Astro Tripod & Wedge (Optional)

22. Latitude Adjustment Screw
23. Bubble Level
24. Wedge Attachment Screw (3)
25. Azimuth Adjustment Screw (2)
26. Camera Extension Tube (on tripod)
27. Leg Extension Lock
28. Latitude Scale
29. Latitude Locking Knob (2)
30. Latitude Locking Knob (2)

You will need to adjust the angle of the wedge. For a complete discussion of the equatorial system and orientation to the North Celestial Pole, see the "Setting Up" section of this manual.

- Examine the latitude adjustor bracket at the back of the wedge. Note the bolt that retains it in the tilt plate adjustment slot and the set screw used to make fine adjustments in the angle of the plate. You should adjust the tilt plate to an angle equal to your latitude. Final adjustment will be made with the telescope attached.

Step #3 Attach The Telescope To The Wedge

- Locate the three black round headed thumb screws from the Deluxe Latitude Adjustor Kit. These screws fasten the telescope to the wedge.
- Turn the telescope on its side. Locate the three threaded holes in the bottom of the telescope base. Thread a black headed thumb screw into the hole opposite the power socket. Let it protrude about 3/4 inch. This screw slips into the slot at the top of the wedge's tilt plate and will hold the telescope in place until you can attach the other two thumb screws.
- Locate the Declination Lock at the end of the fork arm. Loosen it so the telescope can rotate freely. Rotate the telescope tube so it is perpendicular to the fork arm. Tighten the Declination Lock.
- Pick up the telescope with both hands using the fork arm as a handle. Slip the black headed bolt into the slotted hole in the top of the wedge tilt plate. The bottom of the telescope drive base should be flat against the upward side of the tilt plate between the sides of the wedge. Tighten the round headed thumb screw.

- Screw in the other two black headed thumb screws to complete the attachment of the telescope to the wedge tilt plate. Tighten everything.

Step #4 Attach The Finderscope

- Locate the finder scope bracket. The two mounting screws are taped to the holes in the bracket.
- Locate the two holes in the back housing of the telescope covered with transparent tape (no screws).
- Orient the bracket so the three alignment screws face the front of the C90 Astro.
- Secure the bracket firmly to the C90 Astro using the two allen head screws packaged with the finder bracket. Screw these into the threaded holes mentioned above.
- Back out the three thumb screws in the front of the finder bracket until they are flush with the inside of the front finder bracket ring.
- Work the rubber "O" ring back to the rear of the finder body.
- Push the finder back towards the rear bracket ring. The "O" ring will then enter the bracket ring and secure the finder to the rear bracket ring. You may have to reposition the "O" ring several times to get the telescope positioned correctly between both bracket rings.
- Tighten the three thumb screws in the front bracket ring so the finder body is in the center of the bracket ring.
- Focus the finder by loosening the knurled ring at the front of the finder. Rotate the lens in or out until focus is obtained, then tighten the knurled ring to secure the lens position.

Step #5 Attach The Counterweights

To insure smooth drive operation and minimum wear to the clutch mechanism, two counterweights are supplied with the C90 Astro Telescope.

- Remove the button head screw from the rear cell (on the side opposite the Declination Setting Circle).
- Thread the counterweights into the vacant threaded hole in the rear cell.
- If you remove the counterweights, be sure to replace the screw to keep dust out of the instrument.

Step #6 Focus The Telescope

- Insert an eyepiece into the star diagonal. While looking through the eyepiece, rotate the large focusing ring around the main telescope tube. Turn the ring clockwise (from the viewing position) for near objects and counter clockwise for distant objects. If you are looking at a star or other astronomical object, turn the ring to produce ever smaller images until it is in focus.

Step #7 Align The Finderscope

For the finderscope to work properly, it must be aligned with the main telescope. The optical axes of both telescopes must be parallel. To make sure this alignment is correct:

- Point the telescope at an object at least 1/2 mile away. A bright star is best (not the sun).
- Position the star in the center of the field of view of the main telescope. (Use the 30mm Kellner eyepiece.)

- Loosen and adjust the three screws on the finderscope bracket until the star is in the center of the cross hair of the finderscope.
- Check to see the alignment is correct each time you use the telescope.

You have now successfully completed the unpacking and basic set up of the Celestron C90 Astro telescope. The telescope is ready to use. With it, you will now be able to make casual observations of terrestrial and astronomical objects. However, a number of alignments must be made for you to get the fullest possible benefits from this carefully manufactured, precision instrument. Some basic alignment procedures are described in the "Getting Started" portion of this manual. More precise alignments, required for use of the telescope in astronomy and astrophotography, are described in "How to Use the C90 Astro" section of this manual.

SETTING UP THE C90 SPOTTING SCOPE

Step #1 Open The Boxes

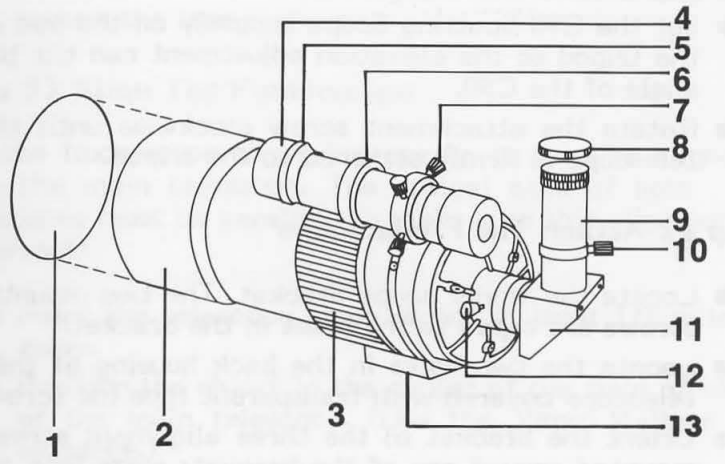
Remove everything from the box. You will find the following parts:

- Black C90 Astro Maksutov-Cassegrain Telescope
- 5 x 24 Finder
- Mounting Bracket
- Prism Star Diagonal
- 18mm Kellner Eyepiece
- 30mm Kellner Eyepiece
- Lens Shade
- Allen Wrench Set
- Front and Rear Lens Covers

Step #2 Attach To A Tripod

The C90 Spotting Scope can be attached to either Celestron's photographic tripod or, to any standard photographic tripod. The 1/4 inch threaded attachment screw, a standard feature on all photographic tripods, mates with the base of the C90 Spotting Scope. If you have purchased a tripod from another manufacturer, follow the specific instructions received with the tripod. If you have purchased Celestron's tripod:

- Extend the tripod legs to the desired height by loosening the leg extension rings on each leg, extending each leg the same amount, and tightening the rings. The Celestron Photographic Tripod has two extensions in each leg. Extend the larger one fully before extending the small one.



C90 Spotting Scope

1. Lens Cap
2. Lens Shade
3. Telescope Focus Ring
4. Finder Focus Ring
5. Finder Focus Lock Ring
6. Finder Bracket
7. Finder Alignment Thumb Screw (3)
8. Eyepiece Dust Cap
9. Eyepiece
10. Eyepiece Securing Thumb Screw
11. Star Diagonal
12. Visual Back Thumb Screw
13. Tripod Mounting Pad

- Unpack the tripod. Loosen the elevation and azimuth adjustments of the tripod. Level the mounting pad. Tighten the locks.
- Set the C90 Spotting Scope securely on the pad of the tripod so the elevation adjustment can tilt the angle of the C90.
- Rotate the attachment screw clockwise until the telescope is firmly attached to the tripod.

Step #2 Attach The Finderscope

- Locate the finder scope bracket. The two mounting screws are taped to the holes in the bracket.
- Locate the two holes in the back housing of the telescope covered with transparent tape (no screws).
- Orient the bracket so the three alignment screws mounted around one of the brackets rings face the front of the C90 Spotting Scope.
- Secure the bracket firmly to the C90 Spotting Scope using the two allen head screws packaged with the finder bracket. Screw these into the threaded holes mentioned above.
- Back out the three thumb screws in the front of the finder bracket until they are flush with the inside of the front finder bracket ring.
- Work the rubber "O" ring back to the rear of the finder body.
- Push the finder back towards the rear bracket ring. The "O" ring will then enter the bracket ring and secure the finder to the rear bracket ring. You may have to reposition the "O" ring several times to get the finder positioned correctly between both bracket rings.
- Tighten the three thumb screws in the front bracket ring so the finder body is in the center of the bracket ring.

- Focus the finder by loosening the knurled ring at the front of the finder. Rotate the lens in or out until focus is obtained. Then tighten the knurled ring to secure the lens position.

Step #3 Align The Finderscope

For the finderscope to work properly, it must be aligned with the main telescope. The optical axes of both telescopes must be parallel. To make sure this alignment is correct:

- Point the telescope at an object at least 1/2 mile away.
- Position the object in the center of the field of view of the main telescope. (Use the 30mm Kellner eyepiece.)
- Loosen and adjust the three screws on the finderscope bracket until the object is in the center of the cross hair of the finderscope.
- Use the lens caps whenever the telescope is not in use to protect the optics of the telescope and finder.
- Check to see that the alignment is correct each time you use the telescope.

NOTE: The distance from the C90 Spotting Scope to the object is important when trying to locate objects with the finder. If the finder and C90 Spotting Scope are aligned on an object 1/2 mile away or more, objects only 20 or 30 feet away will not be centered in the spotting scope. When objects are far away, the optical paths of the finder and the spotting scope are roughly parallel. When the objects are closer, the optical paths must be converging in order to align the instruments. If you usually use your spotting scope to observe objects at distances less than 1/2 mile, align the finderscope using an object at that approximate range.

Step #4 Attach The Prism Diagonal And Eyepiece

If you look through the eyepiece in the visual back of the C90 Spotting Scope the image is inverted and backwards (left to right). The prism star diagonal, a standard accessory, corrects the image but it remains reversed left to right.

- Insert the prism diagonal into the visual back of the C90 Spotting Scope. Secure it with the thumb screw.
- Place the eyepiece into the prism diagonal. Secure it in place with the thumb screw.

You have now successfully completed the unpacking and basic set up of the Celestron C90 Spotting Scope.

SETTING UP THE C90 SPECIAL EDITION BIG EYE

Step #1 Open The Boxes

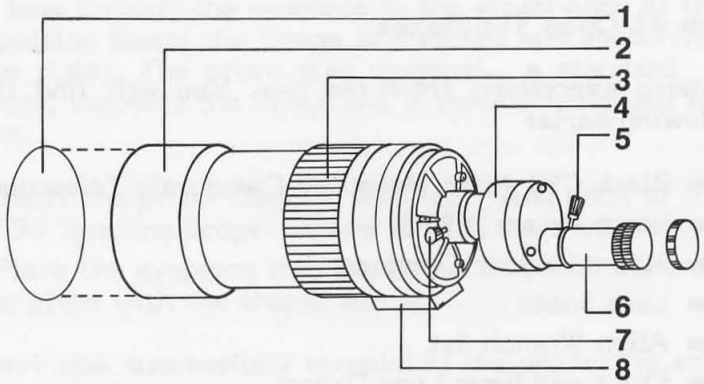
Remove everything from the box. You will find the following parts:

- Black C90 Astro Maksutov-Cassegrain Telescope
- Porro Prism (0.96")
- 30mm Kellner Eyepiece
- Lens Shade
- Allen Wrench Set
- Front and Rear Lens Covers

Step #2 Attach To A Tripod

The C90 Special Edition Big Eye can be attached to either Celestron's photographic tripod or, to any standard photographic tripod. The 1/4 inch threaded attachment screw, a standard feature on all photographic tripods, mates with the base of the Big Eye spotting scope. If you have purchased a tripod from another manufacturer, follow the specific instructions received with the tripod. If you have purchased Celestron's tripod:

- Extend the tripod legs to the desired height by loosening the leg extension rings on each leg, extending each leg the same amount, and tightening the rings. The Celestron Photographic Tripod has two extensions in each leg. Extend the larger one fully before extending the small one.
- Unpack the tripod. Loosen the elevation and azimuth adjustments of the tripod. Level the mounting pad. Tighten the locks.
- Set the Big Eye securely on the pad of the tripod so the elevation adjustment raises and lowers it.



C90 Special Edition Big Eye

1. Lens Cap
2. Lens Shade
3. Focus Ring
4. Porro Prism
5. Eyepiece Securing Thumb Screw
6. Eyepiece
7. Porro Prism Securing Thumb Screw
8. Tripod Mounting Pad

- Rotate the attachment screw clockwise until the telescope is firmly attached to the tripod.

Step #3 Attach The Porro Prism And Eyepiece

If you look through the eyepiece in the back of the visual back on the Big Eye, the image is inverted and backwards (left to right). The porro prism allows you to see the image right side up and oriented left to right.

- Insert the porro prism into the visual back of the Big Eye. Secure it with the thumb screw.
- Place the eyepiece into the porro prism. Secure it with the thumb screw.

You have now successfully completed the unpacking and basic set up of the Celestron C90 Special Edition Big Eye.

SETTING UP THE C90 TELEPHOTO LENS

Step #1 Open The Boxes

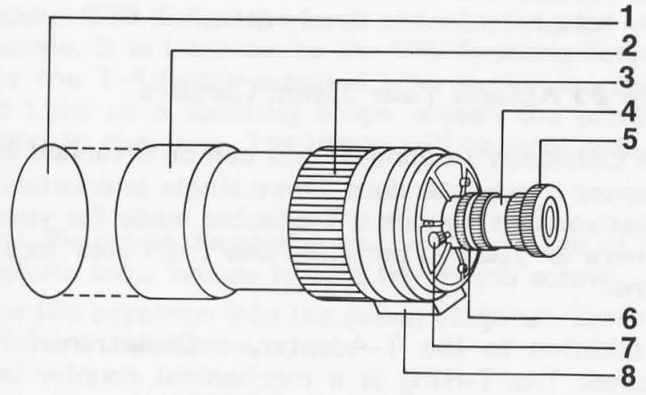
Remove everything from the box. You will find the following parts:

- Black C90 Astro Maksutov-Cassegrain Telescope
- T-Adapter
- Prism Star Diagonal
- 18mm Kellner Eyepiece
- 30mm Kellner Eyepiece
- Lens Shade
- Allen Wrench Set
- Front and Rear Lens Covers

Step #2 Attach To A Tripod

The C90 Telephoto Lens can be attached to either Celestron's photographic tripod or, to any standard photographic tripod. The 1/4 inch threaded attachment screw, a standard feature on all photographic tripods, mates with the base of the Telephoto Lens. If you have purchased a tripod from another manufacturer, follow the specific instructions received with the tripod. If you have purchased Celestron's tripod:

- Extend the tripod legs to the desired height by loosening the leg extension rings on each leg, extending each leg the same amount, and tightening the rings. The Celestron Photographic Tripod has two extensions in each leg. Extend the larger one fully before extending the small one.
- Unpack the tripod. Loosen the elevation and azimuth adjustments of the tripod. Level the mounting pad. Tighten the locks.



C90 Telephoto Lens

1. Lens Cap
2. Lens Shade
3. Focus Ring
4. T-Adapter
5. T-Ring
6. T-Adapter Attachment Ring
7. Eyepiece Securing Thumb Screw
8. Tripod Mounting Pad

- Set the Telephoto Lens securely on the pad of the tripod so the elevation adjustment raises and lowers it.
- Rotate the attachment screw clockwise until the telephoto lens is firmly attached to the tripod.

Step #3 Attach Your 35mm Camera

The Celestron Telephoto Lens can be attached with a T-Adapter to any standard 35mm single lens reflex camera. Celestron can provide a T-adapter made for your specific camera or you can purchase one from your local camera store.

In addition to the T-Adapter, a Celestron T-Ring is needed. The T-Ring is a mechanical coupler used to attach your camera to the C90 Telephoto Lens. Don't confuse the nomenclature. Celestron calls the accessory that fits into the camera body the T-Ring. They are also known as T-Mounts or T-2 Mounts in camera stores. The T-Adapter (in Celestron's terms) is the adapter which converts the threads on the back of the Telephoto Lens to a Universal Thread.

- Rotate the T-Ring clockwise to attach it to the T-Adapter supplied with the C90 Telephoto.
- Attach your Camera to the T-Ring.
- Attach the camera and the T-Ring/T-Adapter combination to the back of the C90 Telephoto by rotating the camera combination clockwise.
- The outside of the T-Ring has three small set screws which can be adjusted. to allow for proper orientation of the camera in relation to the lens. Using a small jeweler's screwdriver, loosen the three screws, rotate the camera until it is oriented properly (usually horizontal or vertical), and then tighten the set screws.

Step #4 Using The Telephoto Lens As A Spotting Scope

The Celestron C90 Telephoto Lens can also be used as a spotting scope. It is identical to the C90 Spotting Scope, except for the T-Adapter supplied with it. To use the Telephoto Lens as a Spotting Scope attach the prism diagonal and an eyepiece. The image will be right side up. To do this:

- Insert the prism diagonal into the visual back of the telephoto lens. Secure it with the thumb screw.
- Place the eyepiece into the prism diagonal. Secure it with the thumb screw.

You have now successfully completed the unpacking and basic set up of the Celestron C90 Telephoto Lens.

GETTING STARTED

Having set up the C90, you are probably ready to look at something ... the sailboat out in the channel, or perhaps, the stars. Whether you are earth-bound or star bound, there is a lot more to learn about using your new instrument. Let's take a look!

THE EYEPIECE AND MAGNIFICATION

A telescope has one task: to form an optical image. That task is performed by the primary optical element of the telescope. The eyepiece magnifies the image formed by the primary optical element enabling you to see it with your eye. You cannot see anything through your C90 Spotting Scope, Big Eye or C90 Astro without an eyepiece, which is also known as an ocular or magnifier.

Magnification (or power) in a telescope is a function of the focal lengths of the eyepiece and the telescope. Focal lengths are marked on the outside of your Celestron telescope and eyepieces.

To calculate the magnification of your combination of telescope and eyepiece divide the focal length of the telescope by the focal length of the eyepiece. For example, if you are using the 1000mm focal length Celestron C90 telescope with the 18mm Kellner eyepiece, the magnification of the object is about 55 times larger than what you can see with your eye.

$$\frac{1000mm}{18mm}=55.56$$

If you change to a 30mm Kellner eyepiece, the magnification will be about 33 times larger than what you can see with your eye.

Two eyepieces (18mm Kellner and 30mm Kellner, both 0.96 inch) are standard with your C90 Spotting Scope and the C90 Astro telescope. The 30mm Kellner is standard with the Big Eye Spotting Scope. Other eyepieces are available with different diameters and focal lengths. A Large Accessory Ring is needed. (See "Expanding Your Celestron System".)

To take a look, start with the 18mm Kellner eyepiece. Slip it into the star diagonal and secure it in place with the thumb screw. If you have the Big Eye, slip in the Porro Prism and the 30mm Kellner eyepiece.

YOUR FIRST LOOK - - ON EARTH

Celestron's C90 Series instruments will give you a detailed look at many exciting objects on earth. Select an object that is fairly bright and close and can be viewed without pointing the telescope through window glass, haze, or heat waves. Remember any telescope only magnifies what you see with your eye, so thick haze or fog will also be magnified. Viewing is best when the air is clear, clean and free of disturbances.

To raise the tube of your Celestron into viewing position, loosen the motion locks on your tripod. If you loosen the locks very slightly the tripod can be adjusted without retightening the locks each time you look at a new object.

If you are using the C90 Spotting Scope, sight in on the object through the finderscope by adjusting the tripod. Center the object of interest on the crosshairs of the finderscope. Now look through the main telescope. If the object you've chosen is relatively close, you might still have to hunt for the object a little to get it into the main field of the telescope. Focus your C90 Spotting Scope with the focus ring on the tube.

After you have located and focused on an object, leave the spotting scope where it is and replace the 18mm Kellner eyepiece with your 30mm Kellner ocular. Now look again. Everything is smaller. You have just learned a little bit about why different eyepieces are supplied with your spotting scope and why you will someday probably want to add other eyepieces to your system.

YOUR FIRST LOOK - - TOWARDS THE UNIVERSE

To get your first look at the moon or the stars with your C90 Astro, select an object that is fairly bright and close. (Although these tips on astronomical use mainly apply to the C90 Astro, you can also locate and see some celestial objects like the moon with the C90 spotting scopes.) Again, don't point the telescope through window glass, haze, or heat waves. We'd like your first impression to be a good one.

REMEMBER! NEVER ATTEMPT TO LOOK AT THE SUN THROUGH YOUR CELESTRON OR ITS FINDERSCOPE WITHOUT THE PROPER PROFESSIONALLY-MADE SOLAR OBSERVING EQUIPMENT! YOUR EYES CAN BE INSTANTLY AND PERMANENTLY DAMAGED EVEN DURING AN ECLIPSE.

To raise the tube of your Celestron into viewing position, release the clamp at the top of the fork tine nearest the finderscope. This clamp is called the Declination Lock. Move the tube and lock the clamp.

DO NOT MOVE THE TELESCOPE TUBE WHILE THE DECLINATION OR RIGHT ASCENSION CLAMPS ARE LOCKED.

At the base of your Celestron is another clamp. This clamp is called the Right Ascension Clamp. Unlock it, grasp one of the fork tines and swivel the tube in the general direction you'll be looking. Then lock the clamp.

Once you've found an object of interest, sight in on it through the finderscope. If the object you've chosen is relatively close, you might still have to hunt for the object a little to get it into the main field of the telescope. The finderscope and your main optics should be aligned for infinity so your instrument will be easy to use when looking at astronomical objects. You may have to realign the finderscope when using it on closer terrestrial objects. To center the object of interest on the crosshairs of the finderscope, use the two knurled knobs at the base of the telescope. The knob beside the Right Ascension Clamp is called the Right Ascension Slow Motion Knob. It moves the telescope horizontally. If this control is hard to turn, slightly loosen the Right Ascension clamp.

The knob at the base of the fork tine, called the Declination Slow Motion Knob, raises and lowers the telescope. This knob operates only when the Declination Clamp is locked. It moves the tube very slowly and should be used only to make fine adjustments. If you want to make large adjustments, loosen the Declination Lock, move it by hand, and tighten the Lock.

DO NOT FORCE THE DECLINATION SLOW MOTION KNOB TO TURN. THE TANGENT ARM WHICH IT MOVES (INSIDE THE FORK TINE) MAY HAVE REACHED THE END OF ITS TRAVEL. IF SO, RETURN THE ARM TO THE CENTER OF THE SCREWS TRAVEL, RELEASE THE DECLINATION CLAMP AND RESET THE TUBE. THEN USE THE SLOW MOTION ADJUSTMENT AGAIN.

After you have centered the object in the finderscope, look through the main telescope. When you do have it centered, focus your C90 with the knob to the right of the visual back. Turning this knob alters the position of the primary mirror in relation to the secondary mirror and focuses the telescope. Focus on close objects by turning the knob clockwise and, on distant objects, by turning the knob counter clockwise.

After you have located and focused on an object, leave the telescope where it is and replace the 18mm Kellner eyepiece with your 30mm Kellner ocular. Now look again. Everything will appear smaller.

SOME BASIC THINGS YOU OUGHT TO KNOW

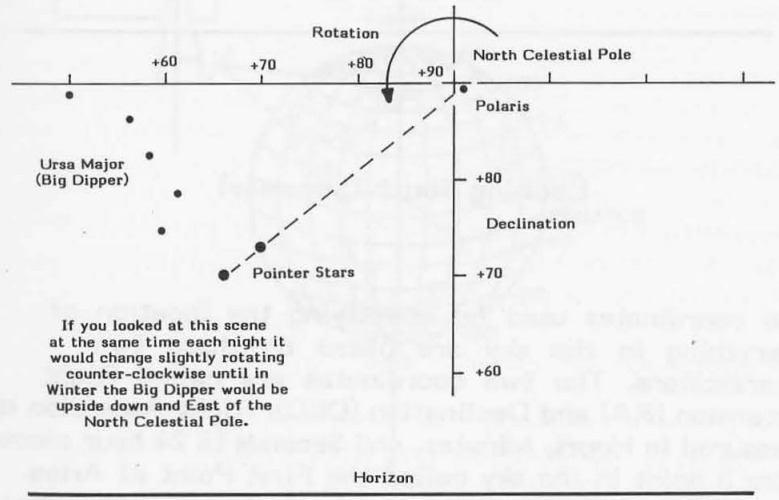
Many people would like to use their telescope for more than looking at a nearby object on earth or the moon. The C90 Astro telescope will allow you to go exploring in the universe. To do this, however, you need to understand some basic astronomy and you will need to align your telescope properly. The rest of this section will provide you with the information you need to properly use the C90 Astro even if you are just a beginner. If you are more advanced, we suggest you glance quickly through the following pages and then go on to the following, more technical information in this manual.

Our Moving Earth

The earth is in constant motion. A giant ball, it rotates like a top around an axis that goes through the North and South Poles. This rotation causes day and night. The apparent movement of the sun (and at night the moon and stars) across the sky is the visual result of the Earth's rotation. The Earth also rotates around the sun. Less obvious on a daily basis, this motion causes our seasons. It also causes the changing scenes in the night sky

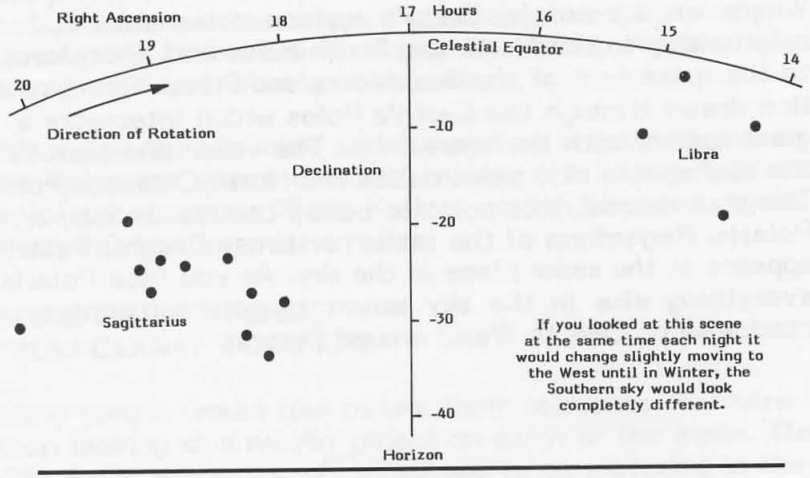
throughout the year. Constellations seen in Winter are hidden by the daylight sun in the Summer. Using a telescope, the rotation is magnified. Nothing you look at in the sky will stay in the telescope's field of view very long!

Where we are on the Earth's surface determines our relationship to the North and South Poles and, therefore, to the movement of the Sun, Moon, and Stars. Visualize a line drawn through the Earth's Poles which intersects a giant sphere with the stars on it. The Polar line pierces the star sphere at a point called the North Celestial Pole. The star nearest this point is called the North Star or Polaris. Regardless of the season or time of night, Polaris appears at the same place in the sky. As you face Polaris, everything else in the sky seems to rotate (counter clockwise or East to West) around Polaris.



Looking North (Summer)

Now visualize a giant circular plane that cuts the earth in half at the Equator. Extend it to intersect the star sphere. This intersection is called the Celestial Equator.

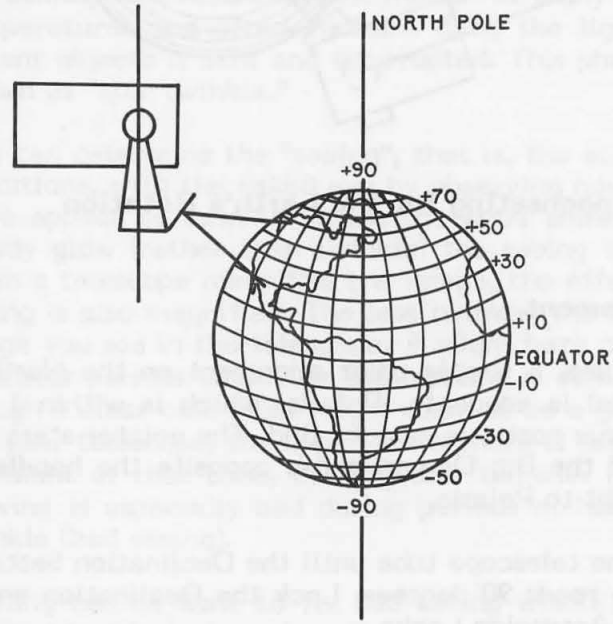


Looking South (Summer)

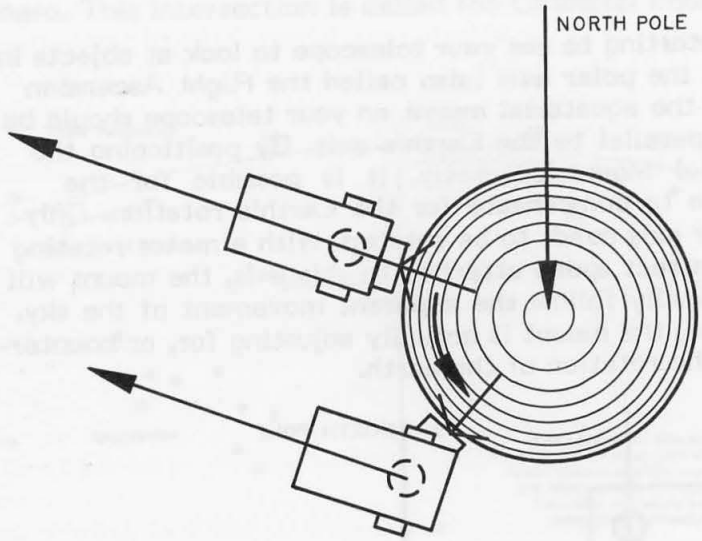
The coordinates used for specifying the location of everything in the sky are based on these two intersections. The two coordinates are called Right Ascension (RA) and Declination (DEC). Right Ascension is measured in Hours, Minutes, and Seconds (a 24 hour clock) from a point in the sky called the First Point of Aries. The numbers increase as you go East along the Celestial Equator. Declination is measured in Degrees, Minutes, and Seconds, North and South of the Celestial Equator. Therefore, the North Celestial Pole is at 90 degrees North.

The Equatorial Mount

Before starting to use your telescope to look at objects in the sky, the polar axis (also called the Right Ascension Axis) of the equatorial mount on your telescope should be aligned parallel to the Earth's axis. By positioning the Equatorial Mount correctly, it is possible for the telescope to compensate for the Earth's rotation. Only the polar axis needs to be rotated. With a motor rotating at the correct speed attached to this axis, the mount will automatically follow the apparent movement of the sky. Of course, the mount is actually adjusting for, or counteracting, the rotation of the earth.



Your Telescope Viewed from the East



Compensating for the Earth's Rotation

Basic Alignment

For casual use, a simple polar alignment on the North Star (Polaris) is adequate. Polaris, which is within 1 degree of true north, is easy to find. The pointer stars in the bowl of the Big Dipper, those opposite the handle, point straight to Polaris.

- Tilt the telescope tube until the Declination Setting Circle reads 90 degrees. Lock the Declination and Right Ascension Locks.
- Move the tripod and adjust the wedge using the Latitude and Azimuth Adjustments until Polaris is in the field of view of the main telescope. Use the finder to make the first few rough adjustments.

LOOKING UPWARDS

Once you have carried out the basic alignment of your system, you are ready to start your journey outward to the moon, the planets, and beyond into deep space. Worlds and universes await you out there.

"Seeing"

"Seeing" is the term astronomers use to describe the atmospheric conditions which alter the quality of image seen in a telescope. Between the object you are looking at and the telescope is the air which is, itself, a lens. Since the atmosphere is in constant motion at many different temperatures and often contains dust, the light from distant objects is bent and interrupted. This phenomena is known as "star twinkle."

You can determine the "seeing", that is, the atmosphere's conditions, with the naked eye by observing how much the stars appear to twinkle. When the stars shine with a steady glow (rather than twinkle) the seeing is steady. When a telescope magnifies the image, the effect of the seeing is also magnified. The less twinkle, the better the image you see in the telescope. A slight haze or fog often indicates periods when the atmosphere is stable. Even though a clear cold night might seem to be a good time to use your telescope, the upper atmosphere is usually quite turbulent at that time, causing star twinkle. Planetary viewing is especially bad during periods of heavy star twinkle (bad seeing).

Nothing can be done to fix bad seeing which is most noticeable when observing planets or the moon. Two things can be done to improve your observations. Try to keep your hands off the tube of the telescope as much as possible to avoid disturbing the air inside the tube. Your body's heat creates air movement. It is also a good practice to avoid rapid movement in front of the telescope.

Observations of deep sky objects such as nebulae and galaxies are less affected by seeing conditions than observations of nearer objects. Here the most important factors are the transparency of the atmosphere and the darkness of your observing site. The darkness of the sky, far from city lights, is very important when viewing deep sky objects and can't be over emphasized. Some objects can't be seen at all in areas with even slight city light pollution. Even the light of the moon will keep you from observing deep sky objects.

What You Can See

The sky is full of billions of objects which you can locate and observe with your telescope. The following is a quick guide to some of them. You should also refer to Ben Meyer's book, "STARWATCH" which is available from Celestron. This easy to follow guide to the nighttime sky has over 400 star charts, maps, photos, and drawings to help you find the planets, stars and nebulae.

The **Moon** is seen most easily during its partial phases and when it is at the highest point in the sky. The most detail is visible along the line dividing the dark from the illuminated part of the Moon called the terminator. Craters can be seen near the terminator because it is there that the shadows cast by high crests are longest.

If the lunar image is too bright for comfortable viewing, a yellow filter or neutral density filter helps reduce the glare. Complete information on filters can be found in "Expanding Your Celestron System."

The **Planets** move in relation to the stars behind them. In fact, the word "planet" means "wanderer". Often planets like Jupiter, Mars, and Saturn move so quickly that it is easy to note their movement in relation to the stars behind them in a few days or weeks. You can locate them easily with the help of a star chart. Planets are best seen at their highest elevation using moderate to high power

(70x to 300x). Higher powers magnify the planets, but often show less detail. All planets except Venus and Mercury follow a line similar to the track of the Moon and Sun.

Venus is a cloudy planet and often resembles a crescent Moon. Clouds block your view of any surface detail. When visible, Venus appears before sunset in the West or before sunrise in the East. At its highest point in the sky, this planet is the brightest object in the sky except for the Sun and the Moon.

Jupiter is very dramatic when it is "up". That is, when it is above the horizon at night. Jupiter's belts are visible at low power and its four Galilean moons are even visible with binoculars. The position of the moons in relation to the planet is a nightly dance of change. Most star charts plot the positions of the four Galilean moons. Sometimes a giant red spot can be seen. A blue filter helps to increase the contrast of the cloud belts and the red spot as well as to reduce glare.

Saturn and its rings are a wonder to behold. The view of Saturn through your telescope will leave you saying "it looks like a picture". Saturn's magnificent ring system is instantly obvious through the C90 Astro. On nights of good seeing you will even be able to observe the shadow of the rings on the planet's surface. See if you can find Cassini's division, a dark space dividing the rings into two separate areas. It is caused by a large "moon" that keeps the dust particles of the rings apart.

Mars is identifiable by its red color. On a good night some surface detail is visible. Details are only possible when the planet is near opposition, that is, when the Earth is between it and the Sun. This occurs every two years. Red and orange filters reduce glare and help increase the contrast of the surface details. A blue filter is useful for emphasizing the atmospheric features of Mars.

Mercury is a small planet that is always very close to the Sun. It is visible only at certain times just before sunrise and just after the sun sets.

Uranus, Neptune, and **Pluto** are difficult to locate and to distinguish from stars. It is a challenge to find and track these fainter planets.

There are billions and billions of **stars** to see. Since they are so far away, no telescope can magnify them. They look like pin points of light at the highest magnification.

Star distance is measured in "Light Years". A light year is the distance light travels in a year. Since light travels 186,000 miles a second, a light year is about 6 trillion miles. Light could go around the earth eight times in one second. The light from the Sun takes about eight minutes to get to the Earth. The nearest star other than our Sun is Alpha Centauri which is most visible in the Southern Hemisphere. It is a little over four light years away. Most stars you can see without a telescope are hundreds to thousands of light years away!

Star clusters are groups of stars relatively close together. Clusters fall into two general categories: open star clusters (sometimes called Galactic Clusters) and globular star clusters.

Open clusters are loosely arranged groups of stars. It is often difficult to distinguish them from background stars. Since open clusters are relatively large groupings, use low power (25x to 50x).

Globular star clusters are tightly packed spherical groups of many thousands of stars. Use low to moderate power (50x to 160x) to see them.

Try to locate the large globular cluster in Hercules or the Pleiades, a large open cluster sometimes called the Seven Sisters.

Double Stars are actually two stars very close together (Polaris is a double star). Often they are so close they cannot be resolved, that is, seen separately. High power (400x to 500x) is often necessary.

Try to locate the Double Double (two double stars in the constellation Lyra). These four stars are easily resolvable.

Nebulae are glowing clouds of gas and other debris. They glow from the light of nearby stars. Nebulae fall into two distinct categories: Planetary Nebulae, which are small and bright, and Diffuse (or Emission) Nebulae, which are large and ill defined.

Planetary nebulae are best seen using moderate magnification (100x to 225x). Diffuse nebulae are best seen at low to moderate magnification (50x to 175x).

Look for the Ring Nebulae (an exploded star), or the Dumbell Nebulae (a large dumbell shaped nebulae). One of the most dramatic nebulae is the great Orion Nebulae seen in the sword of the Orion constellation.

Galaxies are vast, remote "island universes" composed of millions of stars. Galaxies exist in a variety of sizes and shapes. Most are faint. The closest one, Andromeda, is over two million light years away. Don't let that discourage you. This giant can be seen with the unaided eye on good nights and is visually as big as the Moon.

Astronomers have mapped millions of galaxies. There are so many that a map of the galaxies (omitting the Milky Way's stars) still looks like a star map. Galaxies are best seen using low power and an eyepiece with a wide field of view (25x to 75x). For smaller galaxies, use moderate magnification (100x to 225x).

The **Sun**, the center of our solar system, is fascinating to observe. But please remember that you are turning your system towards a powerful source of heat and light. Never forget to take the recommended precautions to protect your eyes and your equipment. When observing the sun, always take the following precautions:

- **Place the solar filter snugly over the front cell of your telescope.**
- **Don't leave your telescope unattended while pointed at the Sun.**
- **Always cap the finderscope to protect it from the heat of the sun's rays.**

With Celestron's solar filters, you will be able to see the Sun's boiling granulated surface and occasionally the magnetic storms called sunspots.

To see Hydrogen explosions and other details on the surface of the Sun, you will need a Hydrogen-Alpha filter. It allows only a very narrow band of color to get through to the eyepiece. Celestron does not offer this type of filter, but other manufacturers do.

Additional filters, such as a neutral density filter, may be used in conjunction with Celestron solar filters to reduce the brightness of the solar image.

CAUTION: WE DO NOT RECOMMEND THE USE OF HERSCHEL PRISMS, SUN DIAGONALS, OR EYEPIECE SOLAR FILTERS BECAUSE THEY HAVE BEEN KNOWN TO SEPARATE OR FRACTURE FROM HEAT. THEY ALSO DO NOT PROTECT THE TELESCOPE FROM THE SUN'S RAYS.

READ THE SAFETY NOTICE AT THE BEGINNING OF THIS MANUAL.

HOW TO USE THE C90 SPOTTING SCOPES

The Celestron spotting scopes will provide you with many years of enjoyment and high quality service. For best performance, your Spotting Scope should be mounted to a stable tripod. Hand-held observations are very difficult due to the scope's high magnification.

To obtain sharp images, the spotting scope needs to be properly focused. This may take some practice. It is easiest to focus first on a bright object, especially if the object you are interested in is dimly lit or in the shade. Find a bright object about the same distance away as the object you want to observe. If the object you are interested in has both light and dark spots on its surface, the brighter spots should provide good focus points.

To focus, rotate the focus ring clockwise for objects further away, and counter clockwise for closer objects. If you forget which direction you rotated the ring, turn the ring fully clockwise until it stops. The lens system will then be focused for infinity and you can start again by turning counter-clockwise.

Another useful focusing technique is to slide the eyepiece in and out of the prism diagonal or porro prism. To do this, loosen the thumb screw slightly. Be careful not to let the eyepiece fall out. Focus the spotting scope by using the focusing ring. Make fine adjustments by moving the eyepiece in and out while you are looking at the object.

HOW TO USE THE C90 ASTRO

Before you can use all the power and flexibility built into the C90 Astro, you will need to align the telescope and its accessories more carefully and accurately than you have so far. A prior section, for example, showed you how to align the instrument with Polaris. This is fine for casual use, but to get fullest use and enjoyment, you will

need to adjust from Polaris to the North Celestial Pole. This section tells you how to carry out this and other alignments.

ALIGNMENT WITH THE NORTH CELESTIAL POLE

The setting circles - - mechanical measuring devices attached to the Right Ascension and Declination axes of the telescope - - and the coordinates of three known stars that are suitably located in the sky - - can be used to align the polar axis with the North Celestial Pole.

The Declination setting circle is divided into degrees. "0" degrees corresponds to the equatorial line, +90 degrees is the North Celestial Pole, -90 degrees is the South Celestial Pole. The Right Ascension setting circle is divided into 24 hours. Each hour is further divided into 12 intervals of 5 minutes. Two pointers are provided for convenience. Remember that one is 12 hours off from the true reading.

Consult a star chart to select three stars and determine their coordinates. We will call the three stars "A", "B", and "C".

- Select the three stars. "A" should be close to the meridian (straight up), "B" should be in the South-East about 20 degrees East of the meridian, and "C" should be in the South-West about 20 degrees West of the meridian. Imagine the three stars as a giant triangle with the base parallel to the southern horizon and the apex pointing North.
- Position the telescope so the polar axis is oriented North.
- Move the telescope's axes until star "A" is centered in the field of view.

- Move the Declination Setting Circle until it reads the Declination of Star "A" according to the coordinates listed in the star chart. You don't need to set the Right Ascension setting circle to the coordinates of the star.
- Move the telescope's axes until the Declination Setting Circle reads the Declination of Star "B". The direction the telescope's Declination axis must be moved to bring the star into the field of view (North or South).
- Repeat for Star "C".
- Move the telescope using the Azimuth and Latitude Adjuster Knobs. Do not loosen the motion locks or use the slow motion controls.
- Move the polar axis according to the following table:

Star "B"	Star "C"	Move Polar Axis
South	North	East
North	South	West
South	South	Raise
North	North	Lower

Repeat this process until all three stars can be located using the readings on the Declination Setting Circle.

ALIGNING THE SETTING CIRCLES

As described above, Setting Circles are mechanical measuring devices attached to the Right Ascension and Declination axes. After the polar axis of your equatorial mount is aligned with the North Celestial Pole, the Setting Circles enable you to set the C90 Astro to the proper coordinates to locate objects in the night sky.

THE SETTING CIRCLES WILL NOT WORK PROPERLY UNLESS THE POLAR AXIS OF YOUR EQUATORIAL MOUNT IS ALIGNED WITH THE NORTH CELESTIAL POLE.

How to Align the Setting Circles

- Locate a bright star that you can identify. Determine its Right Ascension and Declination from a star chart. An alphabetical star listing of bright stars is in the Appendix. Additional information can be found in Ben Mayer's "Starwatch" or other star chart.
- Point the telescope at the star and center it in the field of the main telescope using low magnification.
- Using the highest power eyepiece you have, orient the star so it is in the center of the field of view.
- Set the Right Ascension setting circle to the Right Ascension of the star as indicated in the star chart.
- Set the Declination Setting Circle to the Declination of the star as indicated in the star chart.

GETTING READY

Your telescope will give you increased enjoyment each time you use it since you will be gradually improving your skills. How to observe the skies has to be learned and practiced. The more you do it, the more detail you will see. Take your time and don't get discouraged. Try to set aside a block of time to look through the telescope rather than just taking occasional quick glances. Also take the time to get ready. Before starting:

- Allow sufficient time for the telescope to adjust to the prevailing outdoor temperature. If the temperature is very low and the telescope has been stored in a heated building, the "cooling off" period may be as long as 45 minutes. The telescope may be used, but satisfactory results will be obtained only at low power.
- Plug in the drive motor. (It is not absolutely necessary to run the clock drive although most people prefer to have the telescope compensate for the earth's rotation.)
- Remove the dust caps from the telescope and insert the Star Diagonal in the visual back.
- Select a low power eyepiece and place it in the Star Diagonal.
- If dew condenses on the corrector lens, use a portable electric hair dryer to remove the dew. A brief period of directing warm air towards the corrector should clear the dew. Do not wipe off the dew unless you are certain that the corrector is completely free of dust or other abrasive particles.
- Remain about 15 minutes in a dark location to allow your eyes to adjust so you can detect faint objects. Use a red filter over your flash light to help preserve your night vision when reading a star chart or setting circle.

LOCATING ASTRONOMICAL OBJECTS

Most objects in the sky have been cataloged, classified, and documented in star charts after years of work by dedicated astronomers. Star charts also have pictures or diagrams of the objects in the sky.

Locating Objects Using the Constellations

Many astronomers find it quick and easy to use the constellations to locate objects by knowing the locations of the constellations and by then using the bright stars indicated on the star chart as road signs or pointers. To do this:

- Locate the desired object on a star chart.
- Note its relative position to the main stars of the constellation.
- Locate the main constellation stars in the sky.
- Point the telescope to the approximate position of the desired object relative to the constellation stars.
- See if the object is visible in the telescope's finderscope.
- If it is not visible move the telescope, scanning back and forth systematically across the area in the sky where the object is located relative to the constellation stars.
- If the first few scans do not result in finding the object, go back to the star chart and check the position of the telescope relative to the constellation stars.
- If the object is too small and/or faint to be visible in the finderscope, scan the area looking through the main telescope.

Locating Objects Using the Setting Circles

The setting circles on your telescope make it possible for you to use the coordinates listed in star charts to locate objects in the night sky. Remember, to use the setting circles you must follow the detailed instructions for polar alignment given above.

- Locate the desired object in a star chart and note its equatorial coordinates (Right Ascension and Declination).
- Loosen the Right Ascension and Declination axes clamps on the telescope.
- Move the telescope until the Right Ascension and Declination setting circles match the coordinates given in the star chart.
- Tighten the two axes locks.
- Look in the finder to see the object. If it is bright and you have done everything right, you should be able to see it. If it is there but not in the center of the finder, you may have to check the alignment of the finder or the setting of the circles again. A faint object may not be possible to see in the finder.
- Look in the telescope using your longest focal length eyepiece. If the object is there...enjoy! If it is not, don't panic. It might be just outside the field of view.
- If the object is not visible perhaps it is very faint and you can't see it. Make sure your eyes are accustomed to the dark. It is also possible that the setting circles or the polar axis of the telescope are not correctly oriented. Loosen the axis locks and move the telescope around slightly to see if the desired object is close by.
- If you can't find it, go back and check your work. Make sure the coordinates are right, the circles are set up properly, and the polar axis is oriented properly.

By using your setting circles and a star chart to locate objects in the night sky you will increase your enjoyment of the telescope. The electric clock drive follows any object in the sky for at least an hour without correction.

PHOTOGRAPHY WITH YOUR C90

You can record permanently some of the marvels you see on earth or have found in the skies by using the C90 Telephoto lens or the C90 Astro in combination with your camera. The following sections provide some basic information on both terrestrial and astronomical photography. While it is possible to take a photograph of the moon or Jupiter with a 35mm camera and the C90 Telephoto Lens, this combination is primarily used for terrestrial photography. The best pictures of astronomical objects can be obtained only with the equatorial mount and clock drive provided on the C90 Astro telescope.

When you mate the camera to the telescope's optics, keep in mind that a telescope's eyepiece magnifies the image formed by its primary optical elements -- the lens and mirrors. The size of the image captured on film depends on the focal length of the telescope. For example, the image formed on film by an objective with a 2000mm focal length will be twice as large as the image formed by an objective with a 1000mm focal length.

Special care is needed to keep vibration from affecting the sharpness of your photos when using the high power of the C90. Remember the magnification of the C90 is 20 times greater than a normal camera lens. The telescope should always be mounted on a tripod. Lock the mirrors of the camera in the up position. And use an air release cable (not a metal spring type cable release) or the camera's self timer release.

TERRESTRIAL "TELEPHOTO" PHOTOGRAPHY

Most 35mm single lens reflex cameras can be attached to the C90 Telephoto Lens or C90 Astro with a camera adapter. The Celestron T-Adapter (standard with the C90 Telephoto Lens) and T-Ring convert your camera so it can be attached (see "Expanding Your System"). Using the C90 Telephoto Lens for terrestrial photography is similar to using other types of camera lens, except for its focal length (1000mm) and the resulting larger image size. To help you obtain an excellent photo with the C90, the following sections contain techniques and tips for focusing, exposure and using filters.

Focusing

The C90 Telephoto Lens has a focus range from about 10 feet to infinity. To focus, look through the view finder of the camera and rotate the large focus ring back and forth. Remember, for objects further away, rotate the ring clockwise. For closer objects, rotate counter clockwise. It is good practice to set the C90 at infinity (rotated fully counter clockwise) before beginning to focus on a specific object.

Determining The Correct Exposure

The C90 Telephoto is a f/11 fixed f/ratio lens. The f/ratio determines the amount of light reaching the camera. To get the proper exposure, you must set the shutter speed of the camera to the correct setting or alter the amount of light reaching the camera by using a neutral density filter. The C90 Telephoto Lens is not an "automatic" type lens. (Automatic lenses are adjusted by the camera to the proper f/ratio just before taking the picture.) If your camera has an automatic setting, set it to "manual" mode.

Some types of cameras may have special procedures to follow when using non-automatic lenses. Consult your camera's instruction book. Fully automatic cameras may be used in "auto" if they have an aperture-priority setting which automatically alters the shutter speed according to image intensity.

If you use a separate light meter to determine the necessary shutter speed, point it at the object as seen through your camera. If the object is too far away to take a light reading, make sure you take a reading from an object of comparable value. If extra light from other objects, such as the sky, is read by the light meter the exposure might not be correct. Set the light meter to f/11, take a reading, and adjust the shutter speed.

If you cannot take a light reading as described above, we recommend taking an "incident" light reading. Incident light measurement reflects the average reading of the light falling on the subject as read by pointing your light meter, in comparable light, towards the camera lens. You know if your light meter can operate as an incident meter if there is a white hemispheric bulb on it. Check the light meter's instruction manual for information on how to use it as an incident meter.

Use the following table, if a light meter is not available:

DAYLIGHT EXPOSURE GUIDE FOR THE C90 TELEPHOTO

Set Camera Shutter Speed To Setting Shown

	Film Speed (ASA/ISO)		
Picture Conditions	**ASA 64**	**ASA 200**	**ASA 400**
Bright or Hazy Sun on Sand or Snow	1/125	1/250	1/500
Bright or Hazy Sun with Distinct Shadows	1/60	1/125	1/250
Weak or Hazy Sun with Soft Shadows	1/30*	1/60	1/125
Cloudy but Bright (No Shadows)	1/15*	1/30*	1/125
Open Shade	1/8*	1/15*	1/30*

* A tripod is recommended for these exposure times

The Perfect Picture

The most common cause of a blurry photo is camera motion and vibration. While it is possible to hand hold the C90 Telephoto, it is best to mount the lens and camera on a tripod.

Use a shutter release cable instead of tripping the shutter with the button on the camera. A air bulb release cable will give you even less potential vibration. If your camera allows it, lock the mirror in the "up" position just before taking the picture.

Taking pictures through windows greatly reduces the quality of the picture. Any heat changes or disturbance in the air between the telephoto and the object will also distort the picture.

FILTER PHOTOGRAPHY

Filters can greatly enhance the contrast and color balance of a photograph when you use a long lens like the C90 Telephoto. Use Celestron's Series V Drop In Filter Set. This set consists of six, ring-mounted, optical glass filters that drop into the T-Adapter before it is attached to the C90 Telephoto. The six filters are:

1A - Skylight filter designed primarily for use with color films. The Skylight Filter is a salmon-pink filter and reduces the blueness of shaded, overcast, or distant scenes. No change in exposure is needed when using this filter. The Skylight Filter can also be used as a dust seal.

8 - Yellow filter designed for use with black and white film. The yellow filter provides a good gray scale for natural clouds, sunsets, marine scenes, foliage, and portraits against the sky. Increase the exposure by a factor of 2.

#11 - Yellow/Green filter designed for use with black and white film. This filter lightens foliage by enhancing its texture in bright sunlight. It also darkens the sky and gives the most natural skin tone rendition on panchromatic black and white film. Increase the exposure by a factor of 4.

#25 - Red filter designed for black and white film. This filter produces spectacular cloud pictures and reduces haze on distant objects. It also enhances the texture of wood, stone, sand, and snow. Increase the exposure by a factor of 8.

#80A - Blue filter designed for use with color film. This filter can be used to correct color when using outdoor film with a photoflood light. The overall reddish cast that results from exposing outdoor film with a photoflood is reduced. Increase the exposure by a factor of 4.

#96 - Neutral Density filter designed for use with both black and white and color films. This filter reduces the amount of light reaching the film. This is useful when you want to use a slow shutter speed on moving objects to produce a blurred image or when the image is extremely bright. Increase the exposure factor by a factor of 2-1/2. Do not use the neutral density filter to photograph the sun. It does not provide sufficient protection.

NOTE: Exposure adjustments given above are appropriate if you are using a light meter. If you are using the lens meter, no adjustment is required.

The Celestron Solar Filter can be used to photograph the Sun. (See: Filters in "Expanding Your Celestron System.")

Additional Photographic Accessories

Additional accessories that can be used with your C90 Telephoto include the Tele-Extender to increase magnification, the Tele-Compressor to decrease magnification, and the T-C Adapter to mate the C90 to movie and video cameras.

Detailed descriptions with instructions for these accessories are contained in "Expanding Your Celestron System" in this manual.

ASTROPHOTOGRAPHY

Photographing astronomical objects is challenging and exciting. Your C90 Astro and the optional accessories available from Celestron will enable you to take

magnificent photographs of objects in space. However, even with the best of equipment, you will need to practice and experiment. The sections immediately below on focusing, tracking and precision alignment will get you started right.

Focusing

Focus carefully. If the object is too dim for easy focusing, try focusing on a bright star nearby. If your camera has interchangeable focusing screens, use a perfectly clear screen. This significantly improves apparent image brightness and makes focusing easier and more precise.

Tracking

Even if you have aligned the polar axis on the North Celestial Pole correctly, the motor driven equatorial mounting will not "track" the object to be photographed perfectly. After a five or ten minute exposure, the film will record stars as streaks instead of round points of light.

The primary cause of this minor tracking error is known as Right Ascension Periodicity and is caused by minute variations in the drive gears. Because of the high power of a telescope, even an extremely small variation can cause noticeable image movement in a photograph. Other factors affecting tracking accuracy include: atmospheric refraction which causes the apparent speed of an object to change as its angle above the horizon changes; short period variations in the 110 volt power supply; improper balancing of the telescope and polar misalignment.

Guiding

To compensate for tracking errors, "guiding" of the system is necessary during long exposure astrophotography. To guide the system while the camera is recording the object to be photographed, look through

an optional guide telescope mounted on the side of the main telescope. The guide telescope's eyepiece has a lighted cross hair visible against the dark sky. By positioning a "guide star" on the cross hair any movement can be seen. When you detect that the equatorial mounting is not following properly, make corrections by slightly moving the telescope manually. To guide the C90 Astro, you will need an optional drive corrector. (See: Celestron Drive Correctors in "Expanding Your Celestron System" in this manual.)

Precision Polar Alignment

Image drift in Declination during astrophotography can be eliminated by extremely precise polar alignment. Using the alignment method described below, you will avoid star trailing caused by field rotation and your setting circles will read very accurately. Note, however, that while this method eliminates the need to correct in Declination, you will still need to make Right Ascension corrections.

For this more precise method, you will need an illuminated reticle and Barlow lens. (See "Expanding Your Celestron System".) With those in hand:

- Insert the illuminated reticle and Barlow lens in the star diagonal and point the telescope at a relatively bright star. A star near the meridian and celestial equator is the best choice.
- Watch the image of the star in relation to the illuminated reticle cross hair.

  a. If the star drifts South, the polar axis is pointing too far East.

  b. If the star drifts North, the polar axis is pointing too far West.

- Move the telescope's polar axis in the appropriate direction using the Azimuth and Latitude Adjustment Knobs until the drifting stops.

- The accuracy of this adjustment is increased as you use higher and higher magnifications.
- Next, point the telescope at a fairly bright star near the Eastern horizon and near the celestial equator.
  a. If the star drifts South, the polar axis points too low.
  b. If the star drifts North, the polar axis points too high.
- Monitor the Declination drift using high magnification and make the appropriate adjustments using the azimuth and latitude adjustments.

WHAT TO PHOTOGRAPH

Using one method or another, you can photograph anything you can see through the use of your C90 system. Tips on how to capture various objects on film are contained in the following sections.

Solar Photography

Excellent photographs of the sun can be taken with the C90 and Celestron Solar Filters.

Attach your camera. With an off-axis solar filter and readily available color films, exposure times will range from 1/8 second for ASA 64 films to 1/15 second for ASA 200 films. If you use the full aperture solar filter, the exposure times will be 1/60 and 1/125 respectively. No guiding is necessary. Your Celestron should be set up to track the solar disk.

The tele-extender may be used with a 28mm ocular for extreme close ups of sunspot groups. With ASA 200 film, use an exposure time of about 1/2 second with the full aperture filter.

CAUTION: NEVER ATTEMPT TO PHOTOGRAPH THE SUN WITHOUT A CELESTRON SOLAR FILTER. YOU WILL DAMAGE THE CAMERA AND THE TELESCOPE AND RISK DAMAGE TO YOUR EYES.

Lunar and Planetary Photography

You can photograph the entire lunar disk at the primary focus of the telescope. Depending upon the phase of the moon, exposure times on ASA 64 color film will range from 1/8 second to 1/125 second for the full moon. If exposure time is 1/60 second or less, it is not necessary to have the drive turned on.

Although primary focus photography is satisfactory for small-scale renderings of the moon and planets, extremely long focal lengths are necessary to photograph finer details of the planets. You can increase the image size by inserting an eyepiece between the telescope and the camera. This technique is known as eyepiece projection. The eyepiece acts as an enlarging lens, projecting a magnified image onto the film. The most useful oculars for eyepiece projection are the 25mm, 18mm, and 12mm. The shorter the focal length of the eyepiece, the larger the image on film. The Celestron Tele-Extender makes this easy.

Constellation Photography

Constellations are large groupings of stars much too big to be seen together through your telescope. Use a Piggyback Mount to attach your camera to the side of the telescope for wide field photography. Spectacular photographs of the constellations and the Milky Way can be made with the normal lens of your camera using the telescope as a guide telescope and as a means of accurately tracking the astronomical objects. Since you are photographing at a low magnification, small guiding errors are not as noticeable.

Deep Sky Photography

With some experience photographing large objects such as the moon and the planets, you'll be ready to try deep sky photography of the stars.

To photograph bright objects such as the star cluster in Hercules or the Orion Nebulae, exposure time is about 10 minutes. Exposure time for fainter objects varies from 40 minutes to an hour. (Remember you must guide continually while the shutter of the camera is open.) However, the brightness of stellar and nebulous images at prime focus varies greatly and depends on the size of the telescope. No standard exposure time assures you of a good photograph and you will have to experiment. (See "Exposure Guide" below.)

Comet Photography

Comets move around the sun, each comet in its own orbit. A few comets are large enough and bright enough to be photographed using a camera's telephoto lens with the camera mounted piggyback on a telescope. However, most comets are too faint to be photographed this way and need the light gathering power and magnification of a telescope.

To photograph a comet through the camera's lens piggyback on the telescope, the normal guiding required for wide field photography is adequate. Depending on the brightness of the comet, exposures from 10 minutes to as much as an hour may be required.

To photograph a comet through your telescope, you must guide the telescope so that it follows the unique orbit of the comet. Set up your telescope using the same procedures as with any other long exposure photography. Align with the pole. Since the comet's orbit is different from the stars, you must guide using the image of the comet. Since most comets are irregular in shape, you will

need to pick a specific point on the image of the comet to align with the cross hairs. Again, since the brightness of comets varies greatly, exposures from a few minutes to as much as an hour may be required.

FILMS AND EXPOSURE

While ordinary commercial color and black and white film can be used for many types of astrophotography, this film is designed to be used with relatively high light levels and fast shutter speeds. In astrophotography, film is often exposed to a very low level of light for a long time and does not act the same way. This change in the characteristic of the film is called reciprocity failure.

Special 103a series films designed for astrophotography are available from Eastman Kodak and have lower reciprocity failure. They are generally available from specialized companies and are regularly advertised in astronomy magazines.

103a film is available with different color sensitivities: 103aE is red sensitive; 103aO is blue sensitive; and 103aF is panchromatic (all colors). Use 103aO film for galaxies and reflection nebulae; 103aE film for diffuse (emission) and planetary nebulae; and 103aF for all deep sky objects. Exposure times vary greatly. Kodak color processing is recommended to assure repeatability when using color films.

Exposure

Experiment with exposure time. Take the same picture at several different exposure times to make sure you get a good photograph. This is known as "bracketing." In other words, expose the first photo at the recommended time, then another at half the time and another at double the time. Use a longer exposure time for the crescent moon and a shorter exposure time for the full moon.

Exposure Guide

The exposure guide is intended to aid Celestron telescope users in determining a "starting point" exposure time when taking solar, lunar, and planetary photographs. To avoid needless complications, only three films are listed, and Kodak color processing is recommended to assure repeatability. Normal black and white films have not been included because of the many different developing chemicals and procedures which may alter the results. The color films recommended are balanced for daylight.

Optimal focal ratios and focal lengths are obtained with the oculars listed. The best film and exposure time combination is shown in bold type. These exposure times assume that the planets are near opposition (or greatest elongation) and that all objects are near the meridian (or at their greatest elevation above the horizon).

WHOLE DISC LUNAR PHOTOGRAPHY
(Using the T-Adapter and T-Ring, f/10)

Phase of Moon	Kodachrome 64 (ASA 64)	Ektachrome 200 (ASA 200)	Ektachrome 400 (ASA 400)
Crescent	1/4 sec	1/8 sec	1/15 sec
Quarter	**1/30 sec**	**1/60 sec**	1/125 sec
Full	1/60 sec	1/125 sec	1/250 sec

LUNAR TERMINATOR PHOTOGRAPHY
(Using the Tele-Extender, T-Ring, Counterweight Set, and an Ocular)

Ocular	Kodachrome 64 (ASA 64)	Ektachrome 200 (ASA 200)	Ektachrome 400 (ASA 400)
25mm (f/61)	**2 sec**	**2 sec**	1/4 sec
12mm (f/138)	Not Recommended	3 sec	3 sec

PLANETARY PHOTOGRAPHY
(Using the Tele-Extender, T-Ring, Counterweight Set, and 12mm Ocular @ f/138)

Planet	Kodachrome 64 (ASA 64)	Ektachrome 200 (ASA 200)	Ektachrome 400 (ASA 400)
Mars	**2 sec**	2 sec	1 sec
Jupiter	**4 sec**	1.5 sec	2 sec
Saturn	Not Recommended	**7 sec**	5 sec

SOLAR PHOTOGRAPHY
(Exposure time may vary with density of filters)
(Using the T-Adapter and T-Ring, and Celestron Solar Filter)

Filter	Kodachrome 64 (ASA 64)	Ektachrome 200 (ASA 200)	Ektachrome 400 (ASA 400)
3" Off Axis (f/26)	**1/60 sec**	1/60 sec	1/125 sec
8"	**1/60 sec**	1/60 sec	1/125 sec

SUNSPOT PHOTOGRAPHY

(Using the Tele-Extender, T-Ring, Counterweights, 25mm Ocular, and Celestron Solar Filter

Filter	Kodachrome 64 (ASA 64)	Ektachrome 200 (ASA 200)	Ektachrome 400 (ASA 400)
8"	**1 sec**	1/30 sec	1/60 sec

EXPANDING YOUR CELESTRON SYSTEM

Additional accessories will further your enjoyment when observing and photographing the sky. The most useful accessories for your C90 Series products are shown in the list below. This is followed by a description of these and other pieces of equipment that you will find helpful.

SUGGESTED ACCESSORIES

Visual Accessories

- Sky Maps
- Wedge
- Ocular: 7mm (0.96 inch)
- Adjustable Tripod
- 2x Barlow (0.96 inch)

Photographic Accessories

- T-Adapter
- T-Ring

CELESTRON EYEPIECES

In order that you can choose the right eyepiece for your needs, 0.96 inch and 1-1/4 inch diameter Celestron eyepieces are available in four different optical designs. A Large Accessory Ring is required for the 1-1/4 inch eyepieces.

Celestron Eyepieces

The Kellner eyepiece is designed for general purpose, all around use. This type of eyepiece is used on most introductory telescopes and is best for lunar and planetary viewing. The Kellner eyepiece has a moderate apparent field of view: approximately 40 degrees. Images are perfect at the center of the field of view with some astigmatism and curvature of field. The Kellner eyepiece

has fairly good eye relief, that is, fairly comfortable eye viewing distance. It is better color corrected than more inexpensive eyepieces, such as Ramsden or Huygenian, which are not recommended by Celestron.

The Orthoscopic eyepiece is a well corrected and designed eyepiece. It is excellent for looking at the moon or planets. The Orthoscopic eyepiece has an apparent field of view of approximately 45 degrees. Although better corrected than the Kellner, the Orthoscopic has minimal astigmatism and curvature of field. All Celestron eyepieces are treated with a special anti-reflection coating to prevent ghost images. Even with this coating, the Kellner eyepiece, for example, has some ghost images. The Orthoscopic is not as susceptible to ghost images. Orthoscopic eyepieces have fairly good eye relief.

The Erfle eyepiece is designed for a wide field of view: approximately 60 degrees. With an Erfle eyepiece mounted on your instrument, it will seem like you are looking through a large porthole instead of a long tube. These are excellent eyepieces for observing large areas of the sky. The Erfle does not have as sharp an image at the center of the field of view as a good Orthoscopic eyepiece. However, the image over the entire field is sharper, especially near the edge. Eye relief is excellent.

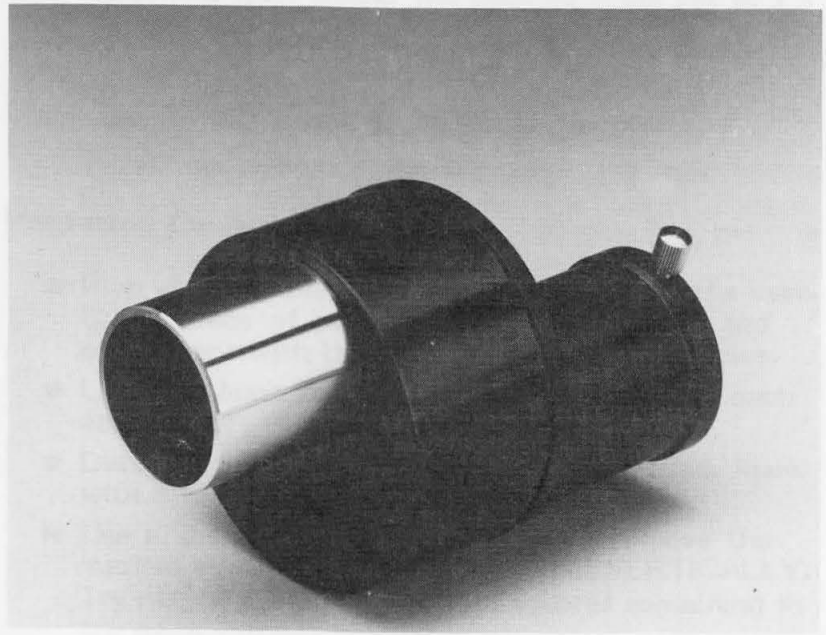
The **Plössl eyepiece** is the finest eyepiece offered by Celestron. Celestron Plössl's have ultra-high contrast multi-coatings, blackened lens edges for high contrast, fine optical and mechanical workmanship, true Plössl design, full light baffling, and minimum eye lens recess for maximum eye relief. The Plössl eyepiece has a wide field of view with a sharp image. In addition, it has a flatter field than any of the other eyepieces. The Plössl eyepiece, for a given focal length, offers the highest image quality with good eye relief and size of field of view. The Celestron Plössls are parfocal: each eyepiece is manufactured so that it is in focus (or nearly so) at the same position in the eyepiece holder regardless of focal length.

The Plössl's only shortcoming is it suffers from ghost images when used on very bright objects such as Jupiter or Venus.

Additional eyepieces must be the same diameter size as the eyepieces supplied with your telescope. After changing eyepieces, it may be necessary to refocus since most eyepieces have a different focus point in relation to the eyepiece holder.

PORRO PRISM

When you look through the eyepiece on the C90 Series without a star diagonal or porro prism, the image is upside down and backwards. Celestron's 0.96 Inch Porro Prism corrects this. A Porro Prism is a set of high quality right angle prisms set at 90 degrees to each other, the same arrangement used in binoculars. Consider using a Porro Prism for bird watching, tracking a moving object like a satellite, reading distant signs or general viewing.



Porro Prism

How to Install the 0.96 Inch Porro Prism

- Insert the Porro Prism into the Visual Back. Secure by tightening the thumb screw.
- Place an eyepiece into the Porro Prism. Secure by tightening the thumb screw on the prism.

ACCESSORY CASE

The Celestron Accessory Case is a injection molded plastic case convenient for storing and transporting Celestron accessories. It is 5-3/4 inches high by 13-1/2 inches wide by 10 inches deep, black in color and has a handle. Two latches keep the case closed. The Celestron name is embossed on the cover.

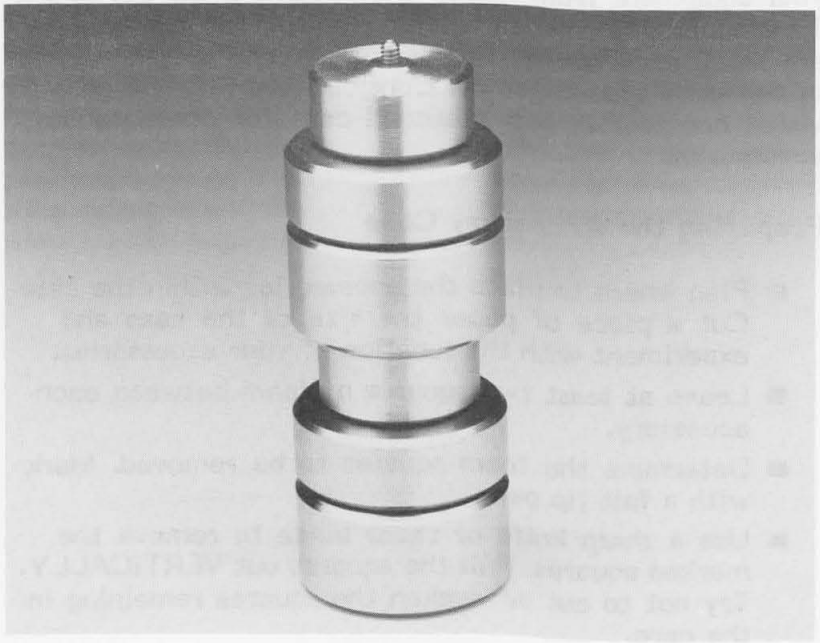
The Accessory Case is filled with foam padding to protect your equipment from shock. The padding is die cut to 1 x 1 cm squares which can be removed to form recesses for any small accessories. This permits you to put accessories of the same type together. Consider adapting one case for visual accessories and a second case for photographic accessories.

Preparing the Accessory Case

- Plan where to place the accessories within the case. Cut a piece of paper the size of the case and experiment with the location of your accessories.
- Leave at least two squares of foam between each accessory.
- Determine the foam squares to be removed. Mark with a felt tip pen.
- Use a sharp knife or razor blade to remove the marked squares. Pull the squares out VERTICALLY. Try not to cut or weaken the squares remaining in the case.

COUNTERWEIGHTS

Counterweight Sets are used to counterbalance accessories added to the C90 Series. Your telescope is balanced with its standard visual accessories attached when you purchase it. Counterweights are required if you add heavier photographic equipment or use heavier visual accessories. If your telescope is out of balance, it will not track astronomical objects accurately and the gears or motor could be damaged.



Counterweight Set

Counterweight Sets available for the C90 Series mount directly on the tube of the telescope using clips supplied with the set. Weights can be added or removed from the rod as required.

How to Use a Counterweight Set

It is difficult to achieve a perfect balance in all telescope positions. The telescope can be perfectly balanced when pointed vertically, but not when pointed horizontally. For the best visual and photographic performance, balance the telescope by first pointing it towards the region of the sky where it will be used.

Step #1 Mount the Counterweight

- Threaded holes are provided in each telescope for attaching accessories such as finderscopes, counterweight sets, and guide telescopes. Each threaded hole is filled with a button head Allen screw (except for the holes meant for the standard finderscope included with each Celestron).

Step #2 Balance the Telescope

- Unlock both axis locks.
- Point the telescope in the direction you are observing or photographing.
- Add the accessories.
- Add weights opposite the position of the accessories.

  If properly balanced, the telescope should not move from its position with the locks released. If a slight movement is noted, tighten the axis locks slightly. If the movement stops, the telescope is balanced.

Step #3 Mount a Counterweight Set

- Attach the clamp to the front cell or lens shade by rotating the clamp screw clockwise.
- Screw the weight to the clamp. Additional weights thread into each other.

VISUAL BACK

The Celestron Visual Back is a black anodized aluminum adapter which physically widens the opening in the rear cell of the telescope to hold a larger diameter eyepiece or star diagonal. The 0.96 Inch Visual Back is built into the back of the C90 Series. A Large Accessory Ring (LAR) is needed to adapt the 1-1/4 Inch Visual Back to the C90.

How To Attach The 1-1/4 Inch Visual Back

- Attach the optional Large Accessory Ring (LAR) to the back of the C90 by rotating it clockwise.
- The knurled ring on the visual back threads onto mating threads on the telescope. Rotate the ring clockwise until it is snug but not tight. The body of the visual back should not rattle or rotate.
- Slip the eyepiece, star diagonal, Multi-Ocular Holder, or Porro Prism into the visual back. Secure by tightening the thumb screw.

STAR DIAGONAL

In some viewing positions it is difficult to look through the eyepiece. The Star Diagonal is designed to make observing more convenient and comfortable. The Star Diagonal diverts the telescope's image at right angles to the normal optical path. The image you see through the diagonal is right side up, but remains reversed left to right.

The C90 Spotting Scope and C90 Astro telescope include a 0.96 inch prism star diagonal. Celestron offers a 1-1/4 Inch Prism Star Diagonal and a 1-1/4 Inch Mirror Star Diagonal to use with the C90 if you use a Large Accessory Ring.

A Prism Star Diagonal is a highly polished piece of optical glass shaped like a triangle. Light bends 90 degrees when it enters one of the right angle faces and exits through the other right angle face. As the light passes through the prism, there is some distortion and light loss.

The Celestron Prism Star Diagonal has a black body finish with a chrome barrel. It is easy to keep clean and requires no special handling. Adjustments aren't necessary since the bending angle is set at 90 degrees by the shape of the prism.

The Mirror Star Diagonal is superior to the Prism Star Diagonal in design and performance. A first surface mirror bends the light. Mirror Star Diagonals reduce the slight distortion of the image and light loss typical of prisms.

The star diagonal requires more care since the aluminum mirror surface is subject to surface contamination and must be kept clean. The adjustable mirror must be kept at a proper angle to assure centering of the image entering the eyepiece.

How To Use and Attach A Star Diagonal

0.96 Inch Star Diagonal

- Insert the Star Diagonal into the back of the C90. Secure it by tightening the thumb screw.
- Insert an eyepiece into the star diagonal. Secure it by tightening the thumb screw on the star diagonal.

1-1/4 Inch Star Diagonal

- Attach the optional Large Accessory Ring (LAR) to the back of the C90 by rotating it clockwise.
- Attach the 1-1/4 Inch Visual Back to the LAR.
- Insert the star diagonal into the visual back. Secure it by tightening the thumb screw.
- Insert an eyepiece into the star diagonal. Secure it by tightening the thumb screw on the star diagonal.

BARLOW LENS

A Barlow Lens multiplies the magnification of an eyepiece. For example, a 20mm eyepiece on a C90 telescope has a magnification of 50x. When the same eyepiece is used with a 2x Barlow, the magnification is increased to 100x. The 0.96 Inch Barlow Lens can be used with the C90 series of products. It is placed in front of a star diagonal.

Barlow Lens

How to Install The Barlow Lens

- Remove any eyepiece or star diagonal from the visual back of the telescope.

- Insert the Barlow Lens as far into the visual back as it will go.
- Secure the Barlow Lens by tightening the thumb screw.
- If using a Star Diagonal, place it into the Barlow Lens and secure it with the thumb screw.
- Insert an appropriate eyepiece into the star diagonal (or directly into the Barlow Lens if not using a star diagonal) and secure it in place with the thumb screw.

FINDERSCOPES

A finderscope is a small refractor telescope used to locate a particular spot in the sky and to assist in positioning the main telescope. A 5 x 24 finderscope is standard on the C90 Astro and Spotting Scope and is available for the other C90 products. A cross hair reticle makes it easier to position an object in the center of the finderscope. Mounting brackets with adjusting thumb screws are used to align the finderscope with the main telescope.

Finderscopes are focused by rotating the front lens cell forward or backward in relation to the eyepiece. Knurled rings secure the front lens cell when the finderscope is focused.

Celestron has a 5 x 24 right angle finderscope that can be added or used in place of the standard finderscope. This finderscope produces an image that is right side up and backwards.

Step #1 How To Attach The Finderscope

- Celestron finderscopes attach to the threaded holes in the rear cell casting of the telescope. Each threaded hole contains an Allen button head screw (except for the holes meant for the standard finderscope included with some models of the C90 Series). There is only one location on the C90 Series where a finderscope can be attached.
- If you are replacing the standard finderscope with a different model, remove it by first removing the finderscope from the attachment bracket. This is done by loosening the adjustment screws that secure the finderscope in the bracket.
- Remove the two Allen button head screws that secure the finderscope bracket to the rear housing of the C90.

- Position the Finderscope Bracket over the two mounting holes. You may have to remove the finderscope from the bracket first. Attach with the screws supplied with the finderscope. Mounting bracket rings should be in front of the mounting holes.
- Attach the finderscope to the mounting bracket:

  1. Straight through finderscopes can be attached directly to the bracket.
  2. Right angle finderscopes must be disassembled before attaching them to the mounting bracket. Remove the front lens cell from the finderscope. On some models, a tightening ring behind the front cell must also be removed.

- Attach the finderscope to the two mounting bracket rings with:

  1. Rubber "O" ring: Push the finderscope into the mounting bracket ring (no thumb screws) until the rubber ring is seated snugly inside the ring. If the finderscope tube has a depression, the rubber ring should be seated in the depression and snug inside the mounting bracket ring.
  2. Six thumb screws: Back the six thumb screws in the mounting bracket so no part is protruding inside the mounting bracket rings. Tighten the screws until each thumb screw contacts the finderscope tube. The thumb screws should not be too tight.

- Attach the front lens cell and tightening ring if you removed it.

Step #2 How To Align The Finderscope

- Focus the finderscope on an object at least a half a mile away. A bright star is best. Depending on the finderscope, focus by rotating the front cell after loosening the tightening ring or by rotating the eyepiece.
- Center your object in the main telescope. Adjust the three thumb screws on the finderscope mounting bracket until the same object is in the center of the cross hairs of the finderscope.
- Final alignment should always be done on a star.

RICH FIELD ADAPTER (RFA)

The Celestron Rich Field Adapter (RFA) is a high quality achromatic lens which compresses the light cone as it exits from the back of the telescope. Field of view is doubled, magnification is halved, and image brightness is quadrupled. Technically, the RFA divides in half the f/ratio (focal length/diameter of lens) of the telescope. Image brightness and field of view are a function of the f/ratio. The 1-1/4 Inch RFA can be used on the C90 series of products with a LAR.

Rich Field Adapter (RFA)

The RFA includes a 20mm Erfle eyepiece, a lens which is a visual adaption of the Celestron Tele-Compressor, an RFA star diagonal, an adapter ring, and a RFA T-Adapter.

The 20mm Erfle supplied with the RFA is the best eyepiece to use. Short focal length eyepieces (below 20mm) should not be used, since the purpose of the RFA is to increase field of view and decrease magnification. However the RFA can be used with any 1-1/4 inch eyepiece.

Some vignetting, that is, obstruction of the edge of the field of view, occurs when the RFA is used with a Celestron 28mm, 32mm, or 40mm eyepiece, but the image does not have the coma associated with short focal length telescopes. Coma is the aberration typical of short focal length telescopes where the image of a star tends to elongate or flare in one direction away from the star's image.

How to Install the RFA

- Remove star diagonal or any other accessory attached to the telescope.
- Attach an optional Large Accessory Ring (LAR) to the threaded portion of the C90 visual back.
- Attach the RFA directly to the LAR by rotating the knurled ring clockwise.
- Position the RFA star diagonal for comfortable viewing before tightening the knurled ring.
- Insert the 20mm Erfle eyepiece into the star diagonal.

DRIVE CORRECTORS

Celestron Drive Correctors facilitate precise, electrically-driven control of a telescope during astrophotography. A Celestron Drive Corrector provides:

- Battery operation of the synchronous Right Ascension motor.
- Adjustment of Right Ascension speed (East/West).
- Push button control (speed up and slow down) of the Right Ascension speed at two rates (guide and slew).
- Push button control of Declination speed (North/South) at two rates (Dual Axis Models only).
- A power supply to run map and setting circle lights.

Two types of Celestron Drive Correctors are available for the C90 Astro, the Single Axis Drive Corrector and the Quartz Single Axis Drive Corrector. The declination slow motion on the C90 Astro cannot be driven by drive correctors available from Celestron.

SINGLE AXIS DRIVE CORRECTOR FOR THE C90 ASTRO TELESCOPE

- Main electronic module housed in a metal case. Controls include:
  a. AC - OFF - DC switch
  b. Map/Setting Circle Lamp Dimmer
  c. Lamp Plug
  d. 110 VAC input plug
  e. 110 VAC output plug
  f. 12 VDC input plug

- Hand control box attached to the main electronic module. Controls include:
  a. Guide motion push buttons (East, West).
  b. Right Ascension (East/West) track rate adjustment.
  c. Slew/Guide selection switch for changing the speed of the push buttons moving the telescope.
- 110 VAC supply cord.
- 12 VDC supply cord with battery clips.
- Lamp light and cord.
- Car cigarette lighter plug.

QUARTZ SINGLE AXIS DRIVE CORRECTOR FOR THE C90 ASTRO TELESCOPE

- Main electronic module housed in a metal case. Controls include:
  a. ON - OFF switch
  b. Map/Setting Circle Lamp Dimmer
  c. Lamp Plug
  d. 110 VAC input plug
  e. 110 VAC output plug
  f. 12 VDC input plug
  g. Push Button Hand Box attachment socket.
  h. Low Battery indicator.
- Hand control box (detachable)includes:
  a. Guide motion push buttons (East, West).
  b. Right Ascension track rate adjustment.
- 110 VAC supply cord.
- 12 VDC supply cord with battery clips.
- Lamp light and cord.
- Stand.

How To Use The Drive Corrector

- Attach the Declination Control using the cord on the declination motor assembly. Plug it in the "DEC" socket on the main power box.
- Plug the Right Ascension drive into the main power box using the cord supplied with the telescope.
- Plug the map light or setting circle lights into the socket marked "LAMP". Adjust the brightness of the lamp with the knob marked "LAMP ADJUST".
- On the Heavy Duty Drive Corrector, select the proper speed setting (SOLAR for the sun, SIDEREAL for stars, or LUNAR for the moon).
- Celestron drive correctors use standard 110 VAC household current (220 V 50 Hz AC available on special order) battery supplied 12 VDC. Since drive correctors use up to 2 amperes of power you need a Ni-cad battery, or motorcycle battery. A battery with at least six ampere hour capacity is recommended.

  With household electricity: Attach the drive corrector to 110 VAC using the supplied cord.

  With a battery: Attach the drive corrector to the battery by plugging the supplied cord into the "DC" socket on the drive corrector. Connect the red battery clip to the positive terminal of the battery and the black wire to the negative terminal. If a car battery is being used, a cigarette lighter plug is also supplied.

Do not use your car battery for an extended photography session. Your battery could be drained!

- Adjust the tracking speed of the drive correctors with the knob on the hand control.
- The quartz drive correctors automatically sense the power source being used. On the non-quartz drive correctors, the ON - OFF switch selects the power source (AC - OFF - DC).
- When the unit is turned on, the Right Ascension drive motor is driven at the proper rate (East to West) to compensate for the earth's daily rotation.
- Set the switch on the non-quartz drive correctors to SLEW. Use the push buttons to move an object into the field of view while looking through the telescope.
- The knob on the hand control of the quartz drive correctors can speed up the adjusting speed to a slew rate. Set the CRYSTAL / MANUAL switch on the hand control to MANUAL and adjust the knob to a fast rate.
- In the GUIDE position (CRYSTAL on quartz drives) the push buttons cause very small, slow changes in the Right Ascension speed and slow movement in the Declination motion (on dual axis models) for guiding during astrophotography. These changes can only be seen at high magnification.
- Right Ascension speed is controlled by changing the frequency of the AC voltage supplied to the synchronous motor. This is done with the buttons marked EAST or WEST on the hand box. You will hear a change in the tone of the hum of the drive corrector.

LARGE ACCESSORY RING (LAR)

The LAR is required to attach accessories made for the C5, C8, C11 and C14 telescopes to the C90 series of products. Accessories requiring the use of the LAR include:

1-1/4 Inch Visual Back
Polarizing Filter Assembly
Series 6 Filter Set
Two Inch Diagonal 5/8/11
Multiple Ocular Holder - 1-1/4 inch
T-Adapter
Any accessory with the Celestron Standard Thread

The LAR is a tube with two sets of threads: one end threads to the C90 telescope and the other end is a Celestron Standard Thread (two inch - 24 TPI).

How To Install The LAR

- Remove the star diagonal from the C90 telescope by loosening the thumb screw.
- Attach the LAR to the back of the C90 by rotating clockwise.
- Attach the accessory to the LAR.

REDUCING BUSHING

Reducing bushings extend the capabilities of your telescope and accessories by allowing you to use different size eyepieces. The 1-1/4 inch to 0.96 inch Reducing Bushing adapts Celestron 1-1/4 inch oculars to any instrument made for .96 inch oculars.

How To Install The Reducing Bushing

- Insert the Reducing Bushing into the 0.96 inch visual back or star diagonal. Secure it by tightening the thumb screw on the visual back.
- Insert any 1-1/4 inch eyepiece into the Reducing Bushing.
- Secure the eyepiece by tightening the thumb screw on the Reducing Bushing.

EXPANDING BUSHING

The Expanding Bushing adapts a 0.96 inch eyepiece for use with telescopes or accessories designed for 1-1/4 inch eyepieces and accessories. A thumb screw secures the Expanding Bushing to the 0.96 inch eyepiece.

How To Install The Expanding Bushing

- Insert the Expanding Bushing into the 1-1/4 inch visual back or star diagonal. Secure it by tightening the thumb screw on the visual back.
- Insert any 0.96 inch eyepiece into the Expanding Bushing.
- Secure the eyepiece by tightening the thumb screw on the Expanding Bushing.

TELE-COMPRESSOR LENS

The Celestron Tele-Compressor is a high quality positive achromatic lens used to enhance astrophotography when used in conjunction with the Celestron C90 series of products. The lens doubles the actual field of view and halves the magnification and quadruples the image brightness. It does this by compressing the light cone as it exits from the back of the telescope. Technically, the Tele-Compressor divides the f/ratio (focal length/diameter of lens) of the telescope in half. A Large Accessory Ring and T-Adapter (C8 Version) is required for the Tele-Compressor.

How To Install The Tele-Compressor Lens

- Remove all accessories from the telescope.
- Attach the Tele-Compressor lens to the T-Adapter by rotating the knurled ring clockwise.
- Attach a T-Ring for your particular camera to the Tele-Compressor.
- Attach your camera to the T-Ring.
- Attach the entire assembly to the telescope by rotating the knurled ring clockwise.

How To Install The Deluxe Tele-Compressor Lens

- Remove all accessories from the telescope.
- Attach the extension tube to the T-Adapter by rotating it clockwise until it is snug.
- Attach the Tele-Compressor to the extension tube by rotating the knurled ring clockwise.
- Attach a T-Ring for your particular camera to the Deluxe Tele-Compressor.
- Attach your camera to the T-Ring.
- Attach the entire assembly to the telescope by rotating the knurled ring clockwise.

T-RINGS

A Celestron T-Ring is a mechanical coupler used to attach your camera to Celestron photographic accessories.

Don't confuse "T-Ring" with "T-Adapter". The accessory that fits into the camera body is called a T-Ring and is unique according to the camera manufacturer. T-Rings are also known as T-Mounts or T-2 Mounts in camera stores. (See T-Adapter.)

How To Install The T-Ring

- Attach the T-Ring to your photographic accessory by rotating it clockwise.
- Attach your camera to the T-Ring.
- Attach the Celestron photographic accessory to the telescope following the instructions for that accessory.

Celestron T-Rings are available for the following cameras:

Alpa
Canon
Contax RTS (Some Yashica/Contax/Zeiss models)
Exacta (Topcon)
Konica
Leicaflex
Leica-M
Minolta
Miranda
Nikon
Pentax (Universal Thread Mount)
Pentax K (Pentax Bayonet Mount)
Petri
Practina
Olympus
Rolleiflex

T-ADAPTERS

The Celestron T-Adapter for the C90 Series is a mechanical adapter which converts the threads on the back of the Celestron telescope to a Universal T-Thread.

Don't confuse "T-Adapter" with "T-Ring". The accessory that fits into the camera body is called a T-Ring and is unique according to the camera manufacturer. The T-Adapter fits between the telescope and the Celestron T-Ring. You need a T-Ring to adapt the T-Thread (on the T-Adapter) to your particular camera . (See T-Ring.)

How To Install The T-Adapter

- Remove all accessories from the telescope.
- Attach the Celestron T-Ring for your particular camera to the T-Adapter.
- Attach your camera to the T-Ring and T-Adapter.
- Attach the entire assembly to the telescope by rotating the knurled ring of the T-Adapter clockwise.

TELE-EXTENDER

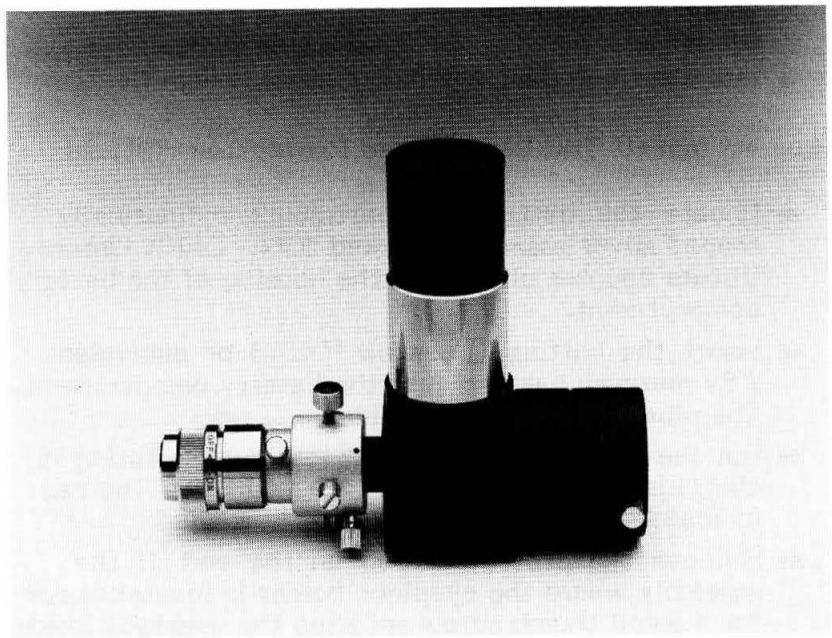
The Celestron Tele-Extender is a threaded tube that connects a Celestron Visual Back with a Celestron T-Ring. When used with an eyepiece installed in the Visual Back, this configuration is called "eyepiece projection" photography.

When you attach a camera directly to a Celestron telescope, you are using the telescope at its "Prime Focus". (The Prime Focus of a telescope is the point where the rays of light from the primary optical element of the telescope come to focus.) This is satisfactory for deep space, terrestrial or large star field photography, but greater magnification is needed when photographing the moon, planets, or small nebulae. At prime focus, planets and small nebulae appear only as a dot on film showing little or no detail because of the size. An eyepiece placed between the telescope and the camera increases image size significantly.

How To Install The Tele-Extender

- Select a 1-1/4 inch eyepiece.
- Insert the eyepiece directly into the visual back (no star diagonal is needed).
- Tighten the thumb screw on the visual back to secure the eyepiece. A set screw in the Tele-Extender is provided to prevent the eyepiece from accidentally falling into the camera.
- Screw the Tele-Extender to the visual back by rotating it clockwise.
- Attach proper T-Ring for your camera type to the Tele-Extender.
- Attach the camera.
- Attach the entire assembly to the telescope by rotating the knurled ring of the visual back clockwise.

ILLUMINATED PROJECTION RETICLE



With an Illuminated Projection Reticle, any standard eyepiece (0.96 inch or 1-1/4 inch) can function as an illuminated cross hair eyepiece.

The Illuminated Projection Reticle:

- Projects an illuminated image of a cross hair into a standard eyepiece. Eyepieces are selected based on magnification and eye relief.
- Orients the image of the cross hair within the field of the view.
- Adjusts the focus of the reticle.

- Transfers the image plane to a more comfortable viewing location (than that of the Illuminated Reticle Ocular) when using the Celestron Off Axis Guider.
- Doesn't need a cord since the battery is contained in the unit.
- Has a built in Barlow lens for higher magnification.

How To Install The Illuminated Projection Reticle

- Locate the battery compartment: cylindrically shaped silver assembly marked "ON - OFF". Unscrew (rotate counter clockwise) the housing of the battery compartment.
- Insert the battery (Duracell PX14B or equivalent 2.7v mercury battery) into the battery compartment. The plus sign should be visible.
- Put the battery housing cap back on by rotating it clockwise. If it is snug, the LED will light. The red indicator verifies it is "ON".
- Remove the protective cap on the end of the assembly where the eyepiece holder is located. Look for a small thumb screw securing the eyepiece inside the tube.
- Insert an eyepiece into the eyepiece holder of the Illuminated Projection Reticle. Secure with the thumb screw.
- Look at the reticle in the eyepiece. If you leave the protective cap on the third end of the assembly, you will see the red image of the reticle. Remember, the Illuminated Projection Reticle is used in the dark. You cannot see the reticle in bright light.
- Loosen the thumb screw and slip the eyepiece in and out of the eyepiece tube to focus the image of the reticle. A threaded focuser allows for fine adjustment of the focus.
- Remove the protective cap from the third end of the assembly.

- Insert the entire assembly into the visual back of the C90.
- Focus the telescope.
- The position and orientation of the cross hair can be changed by rotating the thumb screws at the base of the battery housing.

OPTICAL GLASS SOLAR FILTERS

CAUTION: NEVER LOOK AT THE SUN WITHOUT PROPER PROTECTION. PERMANENT EYE DAMAGE AND BLINDNESS WILL RESULT. SOLAR FILTERS ARE THE ONLY FILTERS AVAILABLE FROM CELESTRON FOR OBSERVING THE SUN. THIS WARNING ALSO APPLIES TO THE FINDERSCOPE ON YOUR TELESCOPE. ALWAYS COVER THE FINDERSCOPE OR GUIDE TELESCOPE WITH ITS LENS COVER BEFORE POINTING THE TELESCOPE AT THE SUN.

Celestron Solar Filters are required to observe and photograph the sun and sun spot activity safely. The C90 Solar Filter fits on the front of the telescope.

Note: To observe Hydrogen activity (the huge eruptions) on the surface and terminator of the sun you will need a special H-Alpha filter which eliminates all wavelengths of light except H-Alpha. Celestron does not offer H-Alpha filters.

How to Install the Solar Filter

- MAKE SURE THE TELESCOPE IS NOT POINTING AT THE SUN!!!
- Cover the front and rear of all finders and guide telescopes with their lens covers.
- Remove the front protective cover of the telescope and the lens shade.
- Place the solar filter over the front of the telescope.
- Point the telescope at the sun.

CARE AND MAINTENANCE

TO CLEAN OR NOT TO CLEAN

Don't let your optics get dirty! Keep them covered when not in use. Use a Celestron Skylight filter on the eyepiece end of the telescope to prevent contaminants from entering the tube. A filter also increases terrestrial, lunar, and planetary contrast.

Always determine whether or not your telescope needs cleaning. Specks of dust or pieces of lint do not impair the visual or photographic performance of your telescope or telephoto lens. But excess cleaning can cause small scratches which harm performance more than lint or dust. These scratches cause light scattering which is very harmful to optical performance. Professional telescopes, used nightly, generally need to be cleaned only every six months to a year.

WHEN CLEANING IS NEEDED

- Use Celestron's Cleaning Kit. KEEP AWAY FROM CHILDREN.
- Clean to remove fingerprints on the outside surface of the corrector plate, or if the instrument has heavy mildew or fog build-up.
- Wash your hands before and after using the cleaning agent.
- Use in a clean and well ventilated area.
- Never apply cleaning agent directly to optical surfaces since excess fluid may penetrate around the edge of the lens and fog the space between optical elements. Apply with the cleaning tissue.
- Do not ingest or get the cleaning agent in your eyes.
- Do not use the Celestron cleaning agent on plastic or plastic optics.

ROUTINE CLEANING

- Clean off dust and grit by using compressed air. Use the high pressure spray nozzle for best results. The first time you use the compressed air, shake the can vigorously and let it stand for half an hour. Always spray and store the can upright.
- Clean off fingerprints with a bit of undiluted Celestron optical cleaning agent ON THE LENS TISSUE. Let the wet tissue adhere to the optical surface, then pull the tissue along the surface against the tension. NEVER RUB OR APPLY PRESSURE. THE SCRATCHES ARE MORE HARMFUL THAN DIRT.
- Dry with a dry tissue.

CLEANING OCULARS & SMALL SURFACES

- Spot clean as described in "Routine Cleaning."
- Use a cotton swab or the corner of a folded piece of lens tissue to get into hard-to-reach spots.

CLEANING CORRECTOR SURFACES - EXTERIOR

- Remove dust and other matter with the can of compressed air.
- A cotton swab is useful for stubborn particles. If sticky materials (such as tree sap) will not come off, use a small amount of acetone on tissue.
- Dilute one part of Celestron cleaning agent with one part of DISTILLED water. Clean a small area. Change tissue frequently to avoid dragging any matter over the optics which causes scratches. Spot clean any leftover streaks with undiluted cleaning agent or by polishing with a dry tissue.

CLEANING MIRROR SURFACES

Mirror surfaces are internal on the C90 and seldom need cleaning. The mirror surfaces would have to be VERY dirty before the telescope's performance is effected. However, should the mirror need cleaning, Celestron offers a cleaning and collimation service for Celestron telescopes and telephoto lenses at the Torrance, CA factory. We use highly accurate tooling for adjusting and cleaning your instrument. Contact the factory for current prices.

LOCK AND DRIVE ADJUSTMENTS (C90 Astro Only)

Right Ascension Lock

The pressure plate under the Right Ascension Lock may need periodic adjustment. To tighten the lock:

- Remove the lock lever. Tighten the exposed screw (using a screw driver) so that you can't rotate the fork manually but can rotate it slightly using the slow motion knob.
- Replace the lock lever in the lock position. Point it to the left. When you unlock the lock, the fork should swing with very slight friction.

Declination Lock

The Declination Lock (at the top of the fork tine) may need periodic adjustment. To tighten the lock:

- Loosen the lock.
- Rotate the lock lever, counter clockwise, a half turn. This will loosen the locking nut (just visible between the lever arms).
- Using a small open end wrench or long nose pliers, rotate the locking nut a half turn.

- Rotate the lock lever clockwise one full turn.
- Tighten the locking nut.

Declination Slow Motion

The Declination slow motion control knob may become loose or sloppy over a period of time. To tighten it:

- Loosen the locking nut at the end of the Declination slow motion screw (the nut is on the outside of the fork tine).
- Advance the cone point screw (inside the locking nut) until it is just snug. Don't make it so tight that the Declination slow motion control knob is too tight.
- Keep the cone point screw from rotating while tightening the locking nut.

STORAGE

When you telescope is not in use, place the lens cap on the front and rear cell opening. The Skylight Filter makes an excellent protective cap for the rear opening.

APPENDIX

RECOMMENDED READING

Many excellent books and other materials are available on astronomy and astrophotography for the amateur astronomer. Some of these are:

BOOKS

Essentials of Astronomy, by Motz and Duveen; Columbia University Press (General astronomy)

How to Use a Telescope, by Sam Brown; Edmund Scientific (Using telescopes)

Amateur Astronomer's Handbook, by J. B. Sidgwick; Dover Publishing (Telescope design, optics, eyepieces, observing, etc.)

Burnham's Celestial Handbook, by Robert Burnham; Dover Publishing (Detailed descriptions of constellations and deep sky objects within them, great for both observers and astrophotographers; in three volumes, alphabetical by constellation)

Star Watch, by Ben Meyer (Available through your Celestron Dealer; an introduction to the stars and astrophotography)

Colours of the Stars, by Malin and Murdin; Cambridge University Press (Astrophotography theory)

Astronomical calendar, by Guy Ottewell; University Press (Calendar in book form of annual sky events)

Mr. Halley's Comet; Sky Publishing Corp. (Story and information about Halley's Comet)

STAR MAPS AND ATLASES

Celestron Sky Maps (Available through your Celestron Dealer; basic star charts for the beginning astronomer)

Sky Atlas 2000.0, by Wil Tirion; Sky Publishing Corp.

(Complete, very detailed star maps for the more advanced amateur astronomer; three versions available: Desk Edition, Field Edition, and Deluxe Edition)

Atlas Borealis, Atlas Eclipticalis and Atlas Australis, by Antonin Becvar; Sky Publishing Corp. (An elaborate and detailed three-volume star atlas, especially useful in astrophotography and photometry)

PERIODICALS

Astronomy, AstroMedia Corp., 625 East. St. Paul Street, P.O. Box 92788, Milwaukee, WI 53202 (Monthly)

Sky and Telescope, Sky Publishing Corp., 49 Bay State Road, Cambridge, MA 02238-1290 (Monthly)

Eyepiece Reference Table

		With Tele-Extender		
Ocular	Visual Magnification	f/Number	EFL (mm)	Photographic Magnification *
6mm	167x	f/321	28956	579x
7.5mm	133x	f/257	23164	463x
9mm	111x	f/214	19304	386x
10mm	100x	f/193	17373	347x
12mm	83x	f/160	14427	288x
15mm	67x	f/128	11582	231x
17mm	58x	f/112	10160	201x
18mm	56x	f/107	9652	193x
22mm	45x	f/88	7924	158x
25mm	40x	f/76	6908	138x
26mm	38x	f/74	6705	134x
36mm	28x	f/53	4775	95x
40mm	25x	f/48	4368	87x
45mm	22x	f/42	3860	77x

* Compared to normal 50mm lens.

The Messier Catalog

Messier Number	Constellation	Type		Magnitude	1970 Position: Right Ascension (Hrs/Min)	1970 Position: Declination (Deg/Min)
M1	Taurus	Planetary Neb.	*	8	05 33	+22 00
M2	Aquila	Globular Cluster		6	21 32	-00 58
M3	Canes Venatici	Globular Cluster	*	6	13 41	+28 32
M4	Scorpius	Globular Cluster		6	16 22	-26 27
M5	Serpens	Globular Cluster		6	15 17	+02 12
M6	Scorpius	Cluster		5	17 38	-32 12
M7	Scorpius	Cluster		5	17 52	-34 48
M8	Sagittarius	Difuse Nebulae	*	7	18 02	-24 20
M9	Ophiuchus	Globular Cluster		7	17 17	-18 29
M10	Ophiuchus	Globular Cluster		7	16 56	-04 04
M11	Scutum	Cluster	*	6	18 49	-06 18
M12	Ophiuchus	Globular Cluster		7	16 46	-01 54
M13	Hercules	Globular Cluster	*	6	16 41	+36 30
M14	Ophiuchus	Globular Cluster		8	17 36	-03 14
M15	Pegasus	Globular Cluster		6	21 32	+12 02
M16	Serpens	Cluster		6	18 17	-13 47
M17	Sagittarius	Difuse Nebulae	*	8	18 18	-16 11
M18	Sagittarius	Cluster		8	18 18	-17 08
M19	Ophiuchus	Globular Cluster		7	17 01	-26 13
M20	Sagittarius	Difuse Nebulae	*	6	18 00	-23 02
M21	Sagittarius	Cluster		7	18 03	-22 30
M22	Sagittarius	Globular Cluster		6	18 34	-25 37
M23	Sagittarius	Cluster		7	17 55	-19 01
M24	Sagittarius	Cluster		5	18 17	-18 26
M25	Sagittarius	Cluster		6	18 30	-19 16
M26	Scutum	Cluster		9	18 44	-09 26
M27	Vulpecula	Planetary Neb.		8	19 58	+22 38
M28	Sagittarius	Globular Cluster		7	18 23	-24 53
M29	Cygnus	Cluster		7	20 23	+38 25
M30	Capricornus	Globular Cluster		8	21 39	-23 30
M31	Andromeda	Spiral Galaxy		5	00 41	+41 07
M32	Andromeda	Eliptical Galaxy		9	00 41	+40 23
M33	Triangulum	Spiral Galaxy		7	01 32	+30 30
M34	Perseus	Cluster		6	02 40	+42 39
M35	Gemini	Cluster		5	06 07	+24 20
M36	Auriga	Cluster		6	05 33	+34 08
M37	Auriga	Cluster		6	05 50	+32 33
M38	Auriga	Cluster		7	05 27	+35 49
M39	Cygnus	Cluster		6	21 32	+48 18
M40	-	-		-	-	-
M41	Canis Major	Cluster		5	06 46	-20 44
M42	Orion	Difuse Nebulae	*	6	05 34	-05 24
M43	Orion	Difuse Nebulae		9	05 34	-05 17
M44	Cnc	Cluster	*	4	08 38	+19 48
M45	Taurus	Cluster	*	2	03 45	+24 02
M46	Puppis	Cluster		6	07 41	-14 45
M47	-	-		-	-	-
M48	Taurus	Cluster		6	08 12	-01 48
M49	Virgo	Eliptical Galaxy		9	12 28	+08 09
M50	Monoceros	Cluster		6	07 02	-08 18
M51	Canes Venatici	Spiral Galaxy	*	8	13 29	+47 21
M52	Cassiopeia	Cluster		7	23 23	+61 26
M53	Coma Beren.	Globular Cluster		8	13 12	+18 20
M54	Sagittarius	Globular Cluster		8	18 53	-30 31
M55	Sagittarius	Globular Cluster		5	19 38	-31 00

* Denotes object of special interest.

The Messier Catalog (Cont.)

Messier Number	Constellation	Type		Magnitude	1970 Position: Right Ascension (Hrs/Min)	1970 Position: Declination (Deg/Min)
M56	Lyra	Globular Cluster		8	19 16	+30 07
M57	Lyra	Planetary Neb.	*	9	18 53	+33 00
M58	Virgo	Spiral Galaxy		9	12 35	+11 58
M59	Virgo	Eliptical Galaxy		10	12 41	+11 48
M60	Virgo	Eliptical Galaxy		9	12 42	+11 43
M61	Virgo	Spiral Galaxy		10	12 20	+04 38
M62	Ophiuchus	Globular Cluster		7	16 59	-30 05
M63	Canes Venatici	Spiral Galaxy		10	13 15	+42 11
M64	Coma Beren.	Spiral Galaxy		9	12 55	+21 41
M65	Leo	Spiral Galaxy		9	11 17	+13 17
M66	Leo	Spiral Galaxy		8	11 19	+13 10
M67	Cnc	Cluster		6	08 49	+11 55
M68	Hydra	Globular Cluster		8	12 38	-26 36
M69	Sagittarius	Globular Cluster		9	18 29	-32 22
M70	Sagittarius	Globular Cluster		10	18 41	-32 20
M71	Sagitta	Globular Cluster		9	19 52	+18 36
M72	Aquarius	Globular Cluster		10	20 52	-12 39
M73	-	-		-	-	-
M74	Pices	Spiral Galaxy		10	01 35	+15 38
M75	Sagittarius	Globular Cluster		8	20 04	+22 01
M76	Perseus	Planetary Neb.		12	01 40	+51 25
M77	Cetus	Spiral Galaxy		9	02 41	-00 09
M78	Orion	Difuse Nebulae		10	05 45	+00 03
M79	Lepus	Globular Cluster		8	05 23	-24 33
M80	Scorpius	Globular Cluster		8	16 15	+22 55
M81	Ursa Major	Spiral Galaxy	*	8	09 54	+69 12
M82	Ursa Major	Irregular Galaxy	*	9	09 54	+69 50
M83	Hydra	Spiral Galaxy		10	13 35	-29 43
M84	Virgo	Eliptical Galaxy		9	12 24	+13 03
M85	Coma Beren.	Eliptical Galaxy		9	12 24	+18 21
M86	Virgo	Eliptical Galaxy		10	12 25	+13 06
M87	Virgo	Eliptical Galaxy		9	12 29	+12 33
M88	Coma Beren.	Spiral Galaxy		10	12 31	+14 35
M89	Virgo	Eliptical Galaxy		10	12 34	+12 43
M90	Virgo	Spiral Galaxy		10	12 34	+13 19
M91	-	-		-	-	-
M92	Hercules	Globular Cluster		6	17 17	+43 11
M93	Puppis	Cluster		6	07 42	-23 48
M94	Canes Venatici	Spiral Galaxy		8	12 50	+41 17
M95	Leo	Spiral Galaxy		10	10 42	+11 52
M96	Leo	Spiral Galaxy		9	10 45	+11 59
M97	Ursa Major	Planetary Neb.	*	12	11 13	+55 12
M98	Coma Beren.	Spiral Galaxy		11	12 12	+15 04
M99	Coma Beren.	Spiral Galaxy		10	12 17	+14 35
M100	Coma Beren.	Spiral Galaxy		11	12 21	+15 59
M101	Ursa Major	Spiral Galaxy		10	14 02	+54 29
M102	Draco	Spiral Galaxy		11	15 06	+55 57
M103	Cassiopeia	Cluster		7	01 31	+60 33
M104	Virgo	Spiral Galaxy	*	9	12 38	-11 28
M105	Leo	Eliptical Galaxy		9	10 46	+12 45
M106	Canes Venatici	Spiral Galaxy		7	12 18	+47 28
M107	Taurus	Globular Cluster		9	16 31	-12 59
M108	Ursa Major	Spiral Galaxy		10	11 10	+55 51
M109	Ursa Major	Spiral Galaxy		11	11 56	+53 32

* Denotes object of special interest.

Alphabetical Listing of Bright Stars

Star	Constellation	Apparent Magnitude	1970 Position Right Ascension (Hrs/Min)	Declination (Deg/Min)
Achernar	Eridanus	0.6	01 37	-57 24
Acrux	Crux	1.4	12 25	-62 59
Aldebaran	Taurus	1.1	04 34	+16 27
Altair	Aquila	0.9	19 49	+08 47
Antares	Scpr ois	1.2	16 28	-26 22
Arcturus	Bootes	0.2	14 14	+19 21
Bellatrix	Orion	1.7	05 24	+06 19
Betelgeuse	Orion	0.1	05 54	+07 24
Canopus	Carina	-0.9	06 23	-52 41
Capella	Auriga	0.2	05 14	+45 48
Deneb	Cygnus	1.3	20 40	+45 10
Fomalhaut	Piscis Aust.	1.3	22 56	-29 47
Pollux	Gemini	1.2	07 43	+28 05
Procyon	Canis Minor	0.5	07 38	+05 18
Regulus	Leo	1.3	10 08	+12 08
Rigel	Orion	0.3	05 13	-08 14
Rigil Kent	Centaurus	0.1	14 38	-60 43
Sirius	Canis Major	-0.16	06 44	-16 40
Spica	Virgo	1.2	13 23	-11 00
Tureis	Carina	2.2	09 16	-59 09
Vega	Lyra	0.1	18 36	+38 36

TECHNICAL INFORMATION

All Models of C90 Series:

Clear Aperture ..... 90mm (3.55")
Light Grasp ..... 160 times the unaided eye
Cassegrain Focal Length ..... 1000 (40")
Magnification Range ..... 22x - 250x
Resolution (Dawes Limit) ..... 1.3 arc seconds
181 line per mm
Mirror Coating ..... Aluminum
Faintest Stellar Magnitude 12
Photographic Speed f/11
Image Scale ..... 1.43 degrees per inch
Illuminated Field ..... 1.5" circle
Near Focus ..... 10'
Secondary Obstruction ..... 1-3/8" (15%)
Eyepieces (0.96") ..... 30mm Kellner (33x)
18mm Kellner (55x)

Applies to Models Noted
(A=Astro, S=Spotting Scope, B=Big Eye, T=Telephoto):

Finderscope (A,S)..... 5 x 24
Star Diagonal (A,S) ..... Prism type (0.96")
Porro Prism (B) ..... Prism Type (0.96")

C90 Astro:

Setting Circle Diameter ..... R.A. - 6-1/4" (Driven)
DEC - 4"
Electric Clock Drive ..... 3 Watts (110v 60Hz)
Slow Motions ..... Manual
Weight ..... 14 lb (without tripod and wedge)
Size Swung Down ..... 7" x 7" x 13"
Carrying Case ..... 9" x 10" x 17"

Specifications may be changed without notification or obligation to existing equipment.